

**LOCH HOPE AFFORESTATION SCHEME.**  
**ENVIRONMENTAL STATEMENT and IMPACT ASSESSMENT.**

Compiled under terms of the European Community Directive 85/337 and The Environmental Assessment (Afforestation) Regulation 1988 (S.I. 1988 No 1207)

## CONTENTS.

### **SECTION 1 : Summaries.**

- 1.1.0 Non-Technical Summary.
- 1.2.0 Technical Summary.

### **SECTION 2 : Proposal.**

- 2.0.0 Proposal.
- 2.1.1 Purpose.
- 2.1.2 Location and Area.
- 2.1.3 Alternative Uses.
- 2.1.4 Alternative Sites.
- 2.2.0 Establishment.
- 2.2.1 Roding.
- 2.2.2 Fencing.
- 2.2.3 Ground Preparation.
- 2.2.4 Drainage.
- 2.2.5 Planting.
- 2.2.6 Planting Layout.
- 2.2.7 Fertilising.
- 2.2.8 Weed Control.
- 2.2.9 Protection (Deer management plan)

### **SECTION 3 : Environmental Impact Assessment.**

- 3.1.0 Terms of Reference.
- 3.2.0 **Baseline Information.**
- 3.2.1 Landscape.
- 3.2.2 Climate.
- 3.2.3 Soil/Geology.
- 3.2.4 Land Use/IFS Classification.
- 3.2.5 Material Assets.
- 3.2.6 Flora.

- 3.2.7 Fauna.
- 3.3.0 Value Judgement Disclaimer.
- 3.4.0 **Likely and Major Impacts.**
- 3.5.0 **Gr. Preparation/Planting Stage.**
- 3.5.1 Fencing.
- 3.5.2 Recreational Access .
- 3.5.3 Mounding.
- 3.5.4 Fertiliser Application.
- 3.5.5 Fauna .
- 3.5.6 Impact Matrix.
- 3.5.7 Mitigating Measures.
- 3.6.0 **Thicket Stage.**
- 3.6.1 Thinning.
- 3.6.2 Secondary Fertiliser Application.
- 3.6.3 Hydrology.
- 3.6.4 Soil Modification. .
- 3.6.5 Fauna.
- 3.6.6 Flora.
- 3.6.7 Visual Intrusion.
- 3.6.8. Material Assets.
- 3.6.9 Impact Matrix.
- 3.6.10 Mitigating Measures.
- 3.7.0 **Canopy Stage.**
- 3.7.1 Extraction of Commercial Timber Element.
- 3.7.2 Flora and Fauna.
- 3.7.3 Impact Matrix.
- 3.7.4 Air.
- 3.7.5 Mitigating Measures.
- 3.8.0 Employment/Economic Benefits to the Region.
- 3.9.0 Landscape design/appraisal.
- 3.10.0 **Further discussion.**
- 3.10.1 Seed source/Genetic Integrity.
- 3.10.2 Recommendations.
- 3.11.0 **Qualifying Statements.**



## SECTION 4 : Appendices.

- 4.1.0 Preliminary Planting proposal.
- 4.2.0 Present Planting Proposal Map.
- 4.3.0 M.L.U.R.I. Soil Map.
- 4.4.0 Transect/Soil Survey Locations Map.
- 4.5.0 Soil Survey Data.
- 4.6.0 Soil Map.
- 4.7.0 M.L.U.R.I. Land-use Map.
- 4.8.0 Species List - Flora.
- 4.8.1 Species List - Fauna.
- 4.9.0 Vegetation Survey Map.
- 4.10.0 Landscape Appraisal.
- 4.11.0 Areas of Material & Ecological Interest Map.
- 4.12.0 N.V.C. Classification of Plant Communities.
- 4.13.0 References.
- 4.14.0 Bibliography.
- 4.15.0 Acknowledgements.

## **SECTION 1 : Summaries.**

### **1.1.0 Non Technical Summary.**

1.1.1 This Environmental Statement supports a proposal for the establishment of a predominantly native type woodland over 854 ha. (refer to section 2 & 4.2.0) by natural regeneration over 34 ha, planting of native species over 641 ha, and the provision of 163 ha open ground on the low lying, east-facing slopes of Loch Hope in N.W. Sutherland .

1.1.2 The proposal attempts to redress the presently distorted imbalance between open-ground and woodland, within the area, which comprises predominantly of rough grazing land of poor productivity, a consequence of long-term human activity and inhibited regeneration due to animal over grazing. The primary objectives thereby are to enhance the landscape, amenity and ecological diversity of the area, whilst providing a future timber asset for use within Eriboll estate.

1.1.4 The most significant, potential long-term impacts associated with the scheme were identified during the E.I.A. process as being;

a) Replacement of open-ground ecosystems and habitats with those of woodlands : Mitigation measures include the retention of sensitive and species rich sites as open spaces, their incorporation into lochside margins, rides, watercourse buffer strips and their subsequent conservation management.

b) Landscape appearance will be significantly modified by the development. Visual impact which may be regarded as subjective (refer to 3.9.1), has been addressed by an appropriate and sympathetic woodland design and composition. Photographic appraisal of landscape features and transparent overlay techniques were used to present a projected landscape appearance (refer to 4.10.1-7) and assist in optimising woodland design.

c) Degradation of archaeological features by ground preparation, planting and natural regeneration is to be reduced by the modification of fenceline boundaries to exclude peat and stone enclosures at Salachaidh from the planting area. Other sites are to be protected by 'holding back' planting to within 35 metres of structures, their

integration into open spaces and shoreline margins, and the periodic removal of natural regeneration.

d) Significant localised reductions to run-off, ground through-flow, and a lowering of the water table may result in elevated acidic input to watercourses from areas of high density non-indigenous conifer planting and may have serious consequences for the survival of fish populations (refer to 3.6.10). Commercially favoured conifers will be replaced by native Scots pine with planting restricted to well draining areas away from watercourses, to drier knolls and intermixed with native broadleaf's in sensitive areas (refer to 3.6.10).

1.1.5 **Short- to mid-term impacts** were identified and are associated with the initial ground preparation stage of the development.

a) The generation of suitable planting sites and L.G.P. tracked vehicle usage will result in disruption to flora, an increase in soil compaction and erosion and the subsequent siltation of watercourses, which could effect the survival of fish populations. This will be avoided by the utilisation of minimum disturbance ground preparation techniques (refer to 2.2.3 and 3.5.3), the provision of extensive and varied buffer strips along ditches, drains, open pools and streams. L.G.P. tracked machines will access the site by alternating routes, following firm ground.

b) Nutrient enrichment of water courses (refer to 3.5.2) may result in eutrophication, and the modification of aquatic animal and plant composition. The provision of extensive and varied buffer strips, reduced fertiliser dosage, hand application, and strict adherence to F.C. guidelines should mitigate this.

c) Visual intrusion is not expected to result from mounding centres when viewed from a distance, but close up views will be effected. Fence posts may constitute a minor intrusion especially apparent when they approach and enter Loch Hope and along the road between Eriboll and Cashel Dhu (refer to 3.5.1 and 3.5.6).

d) Fauna ; Increased human activity on the hillside during the initial phase, could result in considerable disturbance especially to sensitive species of birds, and result in population decline or displacement if prolonged. However, the transition of openland to scrub and thicket establishment is regarded as a productive phase for wildlife. Colonisation and establishment by woodland birds such as willow-, wood warbler, flycatcher, black grouse and the rare redwing may be expected.

e) Exclusion and displacement of grazing and browsing animals will result in reduced grazing pressure, the proliferation of vegetation and the local decline of less competitive plant species. Alternatively, displacement may result in further deterioration of existing plant communities and in elevated levels of deer mortality elsewhere due to a reduction in accessible grazing areas. Therefore management steps will be emplaced to ensure a sustainable population.

f) Larger mammals and birds could get trapped or suffer injury in fencelines, particularly the collision of larger hunting birds of prey is a cause of concern. Heather bunches will be attached to fencelines at strategic points in order to increase visibility.

g) Contamination of soil and water may occur during on-site transport and storage of drums and fuel, and the refuelling process. This potentially significant impact will be avoided by the provision of adequately bunded storage facilities. Contractors will ensure that oil-tanks and loose drums are adequately secured to prevent accidental or malicious spillage and that an appropriate transfer hose is utilised during refuelling operations.

h) Access to the site will be hindered during the initial stages of the development but subsequent installation of styles and gates will facilitate public access thereafter.

1.2.18. It was concluded that predictions as to the long-term effect of the scheme are difficult to ascertain and ironically, once these effects have been realised there is little that can be undertaken to red divert or compensate for them. The overall scale, nature of the woodland composition and layout is regarded to be appropriate to the area, and should maintain wildlife, landscape and human interests. Extensive areas of unplanted open ground will allow the woodlands to be broken up in association with rocky outcrops, crags, areas of geomorphological interest and water courses, enhancing rather than detracting from the scenic attraction. Afforestation with native trees will provide long-term benefits for woodland mammals, birds and invertebrates. Alternatively, afforestation of the area does represent a major and profound modification to existing habitats, ecosystems and species relationships. 'Change' however can be viewed as an inherent and integral element of natural dynamics, whether it is perceived as positive or not is open to subjectivity (refer to 3.11.0).

## 1.2.0 Technical Summary.

1.2.1. This Environmental Statement supports a proposal for the establishment of a predominantly native type woodland over 854 ha. (refer to section 2 & 4.2.0) by natural regeneration over 34 ha, planting of native species over 641 ha, and the provision of 163 ha open ground, on the lower east-facing slopes of Loch Hope in N.W. Sutherland.

1.2.2. The proposal is an attempt to redress the presently distorted imbalance between open-ground and woodland, within the area, which comprises predominantly of rough grazing land of poor productivity, a consequence of long-term human activity and inhibited regeneration due to animal over grazing. The primary objectives thereby are to enhance the landscape, amenity and ecological diversity of the area, whilst providing a future timber asset for use within Eriboll estate. This E.I.A was commissioned by Highland Woodlands and conducted by J. Rathey between July and September 1994. The original planting proposal was subsequently modified as a result of the ongoing E.I.A. procedure.

1.2.3. No statutory designation of the area applies but the site is located at the immediate western boundary of the Kyle of Tongue N.S.A and the eastern boundary of Eriboll S.S.S.I. and has been described as "one of the most scenic areas of inland Sutherland" <sup>1</sup>, providing a "pleasing background to the loch and an attractive backdrop to the more rugged slopes of Ben Hope" (Turner '87) <sup>2</sup>.

1.2.4. Characteristic landscape elements include geomorphological features at Creag na h-Urbhaird and Creag Bhreraig, patches of remnant semi-natural woodland which form corridors along the most significant watercourses and along lengths of the loch shoreline adding attraction and interest to the contrasting hummocks and rolling slopes. Areas of grassland, heather, bracken and flushing provide a patchwork of landscape colour and tone, ranging from light greens through purple and browns, depending on the season (refer to 3.2.1. ).

1.2.5. The site is highly visible from the A.836 between Hope and Altnaharra, which runs along the western shoreline of Loch Hope. Views of the site in it's entirety are restricted by the shoreline shape, geomorphological features, length and ambient weather conditions. The landscape scale may be categorised as small to moderate at the northern end of the site (refer to 10.4.0), large in the middle and southern regions (refer to 4.10.4.0-6.0).



1.2.6. The Macauley Land Use Research Institute, Aberdeen describes the area as being characterised by peat, peaty podzols and peaty gleys, ranging from undulating lowlands to uplands, moderately rocky, bouldery hummocks and rocky valley and slope moraines (refer to 4.3.0, 3.2.3 & 4.6.0). Soil surveys (1982) indicates that land of the proposed woodland scheme is predominantly capable of use as rough grazing, being of low productivity (refer to 4.7.0.). Some smaller patches of improved grazing are also found on site. The Highland Regional Council Indicative Forest Strategy has identified the woodland scheme site as 'sensitive' in view of the size of the proposal and landscape considerations. Present land use comprises of the limited grazing of sheep at extremely low stocking density. The proposed site is of reduced productivity and no agricultural implications are expected.

1.2.7. Vegetation within the surveyed area essentially involved three stages, closed vegetation to patchy vegetation and bare rock, comprised predominantly of N.V.C. communities of M15, M17 and M25, Atlantic heath and mire of the damp-wet type. The most conspicuous plants (refer to 4.8.1) including calluna heath, ericoids, common cottongrass, bog asphodel, tormentil and bracken. Wet flushed areas are characterised by grey matt-moss, butterwort, asphodel, bog myrtle, sedge, ling, common cottongrass, deergrass and purple moorgrass. Three locations are considered to be of considerable merit and conservation value, one of which had previously been rated as a potential S.S.S.I. These are Arnaboll wood (NC45/55: 467586); Greag na h-Urbhaird (NC45/55: 466563) and Creag Bhreag woodland (NC45/55: 456532)(refer to 4.11.0).

1.2.8. A number of animals have been recorded within the study area which is described as typical of north west Sutherland moorlands in that it supports a variety of moorland breeding animals (refer to 4.8.2). Bird species of interest include golden plover, snipe, common sandpiper, dipper, grey wagtails and black-throated diver, breeding greenshanks, peregrine falcons, golden eagles, merlin, buzzard, kestrel and sparrowhawk. The afore-mentioned species are listed on Schedule 1 of the Wildlife and Countryside Act (1981) and/or on the E.C. Directive on the conservation of Wild Birds (Directive 79/409/EC) Annex 1.

1.2.9. Loch Hope is designated as a Salmonoid water in terms of E.C. Directive (78/659/EEC) and, is regarded to be of considerable significance for the

sustainability of local and regional fish stocks (refer to 3.2.7 & 4.11.0). Sport fishing is important to the local community as a source of income and cultural heritage.

1.2.10. A number of interesting archaeological sites are situated within the study area most of which are displayed on 'Roy's map' of the 1780's and on recent O.S. maps of the region. Other sites of substantial archaeological interest are located at Arnaboll outwith the afforestation scheme area.

1.2.11. Likely and major impacts associated with each stage of the proposal have been identified and quantified employing a modified 'Leopold Matrix' system (refer to 3.5.6, 3.6.9 & 3.7.3). The most significant are;

1.2.12. **Ground preparation & planting phase ;**  
(generally regarded as short to mid term and local in nature).

i) Disruption to flora ;

Disruption resulting from the initial fencing and mounding operations will be substantial, but a full recovery, proliferation and increased productivity due to nutrient uptake is to be expected. Indeed the raised mounding sites may serve as valuable sites for the establishment and persistence of sensitive ground layer plant species which would otherwise be outshaded as a result of reduced grazing pressure.

ii) Compaction and erosion of soil ;

Mechanised mounding by L.G.P. vehicles will result in increased local soil compaction and erosion, affecting the soil structure, hydrology and water course sediment load. This may be compounded when wet conditions reduce trafficability and increase poaching risk, especially on steeper slopes. It is essential for the successful spawning and hatching of Salmonidae, that gravel beds should remain free of sand, silt and clay which could cause impaction, prevent the cutting of redds, substantially reduce the flow of oxygenated water through the gravel and deny juveniles refuge from predation.

iii) Fauna ;

Increased human activity on the hillside during the initial phase, could result in considerable disturbance especially to sensitive species of birds and in a population decline or displacement if prolonged. The transition of openland to scrub and thicket establishment is regarded as a productive phase for wildlife. Colonisation and establishment by woodland birds such as willow and wood warbler, flycatcher, black grouse and the rare redwing is to be expected.

iv) Nutrient enrichment of watercourses ;

Leaching of fertiliser from peat may be inevitable as only a limited cation exchange capacity exists for the fixation of applied nutrients. Large scale usage may result in diffuse or dry deposition of phosphorous, the eutrophication of water courses and modification of aquatic fauna and flora composition, although in dystrophic waters this may lead to a beneficial increase in primary productivity. The degree and longevity of impact is influenced by factors such as the applied amount, total area of the catchment basin, rainfall, throughflow and flushing-rate of the catchment store. The H.R.P.B. have advised that the use of phosphate fertiliser may result in the Board's E.Q.S. threshold being surpassed (refer to 3.5.4 & 3.5.7).

v) Visual intrusion ;

Visual intrusion from mounding centres is not expected from a distant viewpoint but the close up view will be affected, although to a much lesser extent than with traditional ploughing techniques. Fence posts will constitute a minor visual intrusion especially apparent when they approach and enter Loch Hope and along the road between Eriboll and Cashel Dhu (refer to 3.5.1 and 3.5.6).

vi) Exclusion and displacement of grazing and browsing animals ;

Reduced grazing pressure will result in the proliferation of vegetation whereby less competitive species will experience local population decline. Displacement may result in increased grazing pressure where access is maintained and a further deterioration of Arnaboll wood may occur. Elevated levels of deer mortality may result from a reduction in accessible grazing areas.

vii) Collision risk to hunting birds of prey ;

Larger mammals and birds which could get trapped or suffer injury in fencelines. Of particular concern is the collision of larger hunting birds of prey, "there may be a high risk of eagles colliding with forestry fences during hunting" <sup>8</sup>.

viii) Contamination of soil and water ;

The on-site storage and transport of drums and fuel and the refuelling process itself, represent major potential sources of impact to soil and watercourses.

ix) Material Assets ;

Interesting archaeological sites located within the proposed planting area, may be exposed to structural damage or degradation during the mounding operation and by subsequent natural regeneration due to a significant reduction in grazing pressure.

x) Recreational Access ;

Access to the site will be hindered during the initial stages of the scheme. However, during the study period only two individuals were seen to access the site for recreational purposes, hindrance during the initial stages is therefore regarded as insignificant. Subsequently, styles and gates will be installed to facilitate public access.

**Proposed mitigating measures** include ;

a) Ground preparation of inaccessible or sensitive areas, should be undertaken by hand mounding or screefing. Mounding centres should be varied in order to provide the basis of an unevenly structured woodlands and to avoid unsightly linear patterns which may otherwise be apparent upon tree establishment. L.G.P. machines accessing the site, should alternate routes and following areas of firm ground.

b) Nutrient enrichment to watercourses will be mitigated by mid-summer hand application of fertilisers during favourable weather conditions, and by strict adherence to F.C. guidelines. Dosage are to be reduced to 100 kg $ha^{-1}$  for native

broadleaf and a maximum of 150 kg ha<sup>-1</sup> for conifer blocks. Spillage and deposition near flushed wet ground or water courses will be avoided at all times.

c) Siltation and nutrient enrichment of watercourses is to be reduced by the provision of unplanted bufferstrips along ditches, drains and open pools, with a minimum of 10 metres either side. For streams, buffer strips of at least 20 metres width will be established, corridor effects being avoided by the feathering in of trees at strategic points along embankments, thereby creating dapple shade effects and enhancing aquatic habitat diversity. Where water courses approach the lochside, unplanted margin width will be increased to approximately 40-50 metres.

d) Visual intrusion resulting from fencing lines is to be reduced in the short-term by using treated posts which are light green in colour and, are less visible from a distance. Fencing lines are to be hidden or laid out harmoniously with landform contours, seeking where practicable to avoid a geometrical layout.

e) Arnaboll wood is increasingly at risk of further decline, due to advanced ageing and restricted regeneration. Management steps are to be undertaken to maintain stocking densities of grazing and browsing animals at sustainable levels. This may entail restricting sheep access and grazing period. In the case of deer that are less readily manipulated, a regime of selective culls and/or diversionary feeding may be undertaken until the newly planted trees are established and the area is reopened.

f) Visibility of the upper fence line mesh should be enhanced. The R.S.P.B. suggests that this may be achieved by attaching bunches of heather, this is acceptable to the applicant.

g) Interesting archaeological sites should be left unplanted to within 35 metres, maintained and incorporated into open spaces. Where practical rides and footpaths should be interlinked with sites to allow easy public access and serve as wildlife corridors. Management steps such as mowing or strimming should be undertaken periodically to remove regeneration. Enclosures at Salachaid are to be safeguarded by modification of the upper boundary fenceline. Thus, remaining outside the planting area and subject to grazing pressure they should not be affected by planting operations or require preservation management (refer to 4.2.0).

h) Ecologically rich and interesting areas can be easily incorporated into the unplanted shoreline margins which are to be varied and substantial, enabling the sustainable representation of the diverse habitat types and ecological diversity as well as adding accentuation and interest to the shoreline features and shape. Areas of dystrophic flush, peat, and heather should be left unplanted and/or incorporated into open spaces and deer lawns, care being taken that the geometric orientation and dimensions are adequate to provide viable animal habitats ( refer to 3.5.7 & 4.11.0).

i) Potential impacts as a result of fuel-oil spillage should be mitigated by the provision of adequately bunded, plastic lined storage facilities. Contractors must ensure that oil-tanks and loose drums are adequately secured to prevent accidental or malicious spillage. An appropriate transfer hose should be utilised during refuelling operations.

#### 1.2.13. **Woodland thicket stage ;**

i) Significant localised reductions to run-off, ground through-flow, and lowering of the water table;

Could result in episodes of elevated acidic input to watercourses from areas of high density non-indigenous conifer planting, as a consequence of increased evapotranspiration and interception levels. This may have serious consequences for the survival of fish populations due to elevated levels of mortality during the susceptible early stages of development (refer to 3.6.10).

ii) Depletion of open-ground bird communities ;

Canopy-dwelling woodland bird-fauna, will become the most characteristic group, the survival of openland species being dependent on the availability of unplanted areas such as rides, deer lawns and stream banks. In terms of species variety and composition they usually remain impoverished.

iii) Visual impact of fenceline ;

May have a moderate impact from a distance, where grazing along the fenceline may lead to an abrupt change of vegetation colour but, it is recognised that the trees themselves represent the greatest long term visual intrusion.

1.2.14 **Proposed mitigating measures** include ;

a) Commercially favoured coniferous species such as Sitka spruce are to be substituted by native conifer (*Pinus sylvestris*), planting being restricted to well draining areas away from watercourses and to drier knolls. Should conifer blocks be sited adjacent to watercourses then mixed planting with birch may serve to mitigate acidification (refer to 3.6.10).

b) Openland fauna and flora interests should be maintained by leaving loch shorelines, flushes and peat mires unplanted and, in sufficient proportions that habitat and species variety be maintained. Appropriate management strategies being implemented to assure the periodical removal and control of rank bracken, heather and regeneration.

1.2.15. **Woodland maturity phase ;**

i) Soil erosion and compaction ;

Will result during the timber extraction operation where L.P.G. machines continually use the same tracks or when operations proceed during adverse weather conditions.

ii) Disturbance of flora and fauna as a result of timber extraction operations.

ii) Deterioration of the roadway surface between Eriboll and Cashel Dhu may result from the transport of timber, machines and materials during extraction operations.

iii) Long-term visual impact of the woodland on landscape; It is accepted that the trees themselves will represent the greatest long-term visual intrusion, the nature and degree of visual impact is however influenced by a number of factors such as distance, lighting conditions and atmospheric clarity which are restrictive in the Hope area. The nature and scale of the woodland layout and composition are appropriate and should in fact enhance the scenic variety and value of the area, which for a greater part is devoid of tree cover. This should enhance rather than detract from the visual attractiveness, however value judgement is subjective and relative to individual perception (refer to 3.9.1, 4.10.3,-10.5,-10.7)..



**Proposed mitigating measures** include ;

- a) L.G.P. machinery utilise firm ground avoiding boggy areas, wherever possible using alternating routes during site operations
- b) Timber extraction from inaccessible and sensitive areas should be undertaken using traditional or alternative methods including selective felling and removal.
- c) The roadway surface between Eriboll and Cashel Dhu is to be reinstatement when damaged or in need of repair.

1.2.16. Further discussions were related to the woodland establishment and the preservation of genetic integrity within ecologically important sites adjacent to the proposed woodland scheme, and to appropriate seed sources for planting stock (refer to 3.10.1).

1.2.17. Suggestions include the utilisation of immediate local seed sources, and that woodlands establishment be undertaken within a two year time-frame. This would reduce the severity of potential impacts during the initial stagea of the scheme and facilitate the collection of locally provenant seeds and their subsequent propagation for planting stock (refer to 3.10.2).

1.2.18. The eco-resource baseline study represents a useful database for future monitoring of the woodlands scheme although, some inadequacies are apparent especially with regard to the composition and distribution of bird, fish, freshwater and terrestrial invertebrate populations. This can be associated with knowledge, survey time, seasonal and resources constraints (refer to 3.11.0).

1.2.19. Predictions as to the long term effect of the scheme are difficult to ascertain and ironically, once these effects have been realised there is little that can be undertaken to redirect or compensate for them. It was concluded that the overall scale, nature of the woodland composition and layout, is appropriate. Extensive areas of unplanted open ground will allow the woodlands to be broken up in association with rocky outcrops, crags, areas of geomorphological interest and water courses, should enhance rather than detract from the visual/scenic attractiveness. The afforestation scheme will benefit woodland mammals, birds and invertebrates by

redressing the balance between open ground and woodlands within the area. Alternatively however afforestation represents a major and profound modification to open ground species composition, habitats and ecosystems and species relationships. 'Change' however can be viewed as an inherent and integral element of natural dynamics, whether it is perceived as positive or not is open to subjectivity (refer to 3.11.0).

## **SECTION 2 : Proposal.**

### **2.1.1 Purpose.**

It is proposed that a predominantly native broadleaf woodland with a limited native conifer element, be established on the site, The objective, being to enhance the conservation, amenity and landscape value of the area, whilst creating a future timber asset for use by the estate.

### **2.1.2 Location and Area.**

The area of the proposed woodland scheme comprises 854 ha. and is located within the Eriboll agricultural estate on the lower slopes of Loch Hope in NW Sutherland, extending from Allt an Locha Chrochaich above the river Strathmore northwards to Allt Ack nan Gamhna near Arnaboll (refer to 4.2.0).

### **2.1.3 Alternative Uses.**

Presently the land is used for the grazing of sheep at low stocking densities, which is increasingly becoming a financially unviable proposition. Although the owner wishes to retain some areas of better grazing at Arnaboll for this purpose, native woodlands establishment would meet the objectives of landscape, conservation and amenity enhancement. In the long-term this would be generally beneficial for wild life and the estate as a whole.

Other alternative land uses which were considered include;

a) To plant trees solely for commercial forestry would require planting of a much greater scale to increase economy and maximise yield. This policy may prove detrimental to conservation objectives and be publicly unacceptable.

b) The management of the site as a grouse-moor would not be financially viable, would not redress the poor condition of the land or, the present imbalance between open-ground and woodland cover. The proposed woodland scheme

however, would provide long-term opportunities for the regeneration and spread of existing woodlands into new areas.

#### **2.1.4 Alternative Sites.**

A considerable proportion of Eriboll estate is designated S.S.S.I. status, therefore suitable alternative sites are lacking. The area of the proposed scheme is of poor land quality and low productivity. Agricultural activities are predominantly centred at Eriboll farm, a considerable distance away. It is accepted that access to some areas of improved grazing will be limited during the establishment phase but no agricultural implications are to be expected.

#### **2.2.0 Establishment.**

##### **2.2.1 Roding.**

No roads are to be constructed at any stage of the development. As the woodland is not a commercial venture any harvesting envisaged in the future will be very small scale. The existing track from Eriboll will be used during the establishment of the scheme and for the transport of extracted timber. A central ride running N-S through the site will provide access for maintenance and silvicultural operations.

##### **2.2.2 Fencing.**

The area will be fenced against stock and deer. High specification deer fencing will be erected along the top (west) boundary and down, protruding into the loch at the northern and southern ends. Thereafter rails will be erected to form a large 'Y' shape in 4/5 feet of water, should deer swim around the first section of the 'Y' they are given the impression of being trapped and should swim back out. Recreational access to the site will be maintained along public rights of way and other roadways by the provision of stiles and gates.

### 2.2.3 Ground Preparation.

In order to create suitable planting sites for the trees, mounds of approximately 0.5 m<sup>2</sup> surface area and 20-30 c.m. in height, will be generated using a continuous moulder trailed behind a L.G.P. tracked vehicle. Inaccessible and sensitive areas are to be hand mounded. Mounding centre densities will be varied in order to provide the basis of an unevenly structured woodlands and to avoid linear patterns on the ground. During operations, areas will be accessed by alternating routes and following hard ground.

### 2.2.4 Drainage.

The site rises gently from approximately 10 metres A.S.L. to about 250 metres A.S.L. The majority of ground is fairly free-draining, therefore no additional drainage will be required. Existing drains will be maintained throughout the duration of the scheme.

### 2.2.5 Planting.

The woodlands composition will be comprised as follows;

Birch ( <i>Betula pubescens</i> )	40%
Alder ( <i>Alnus glutinosa</i> )	12%
Rowan ( <i>Sorbus aucuparia</i> )	15%
Willow ( <i>Salix caprea</i> )	2%
Hazel ( <i>Corylus avellana</i> )	5%
Aspen ( <i>Populus tremula</i> )	5%
Holly ( <i>Ilex aquifolium</i> )	1%
Scots Pine ( <i>Pinus sylvestris</i> )	20%

Birch and alder will be planted in irregular species groups in association with poorer wetter soils, whilst aspen and holly will be established on the drier sites along with rowan. Willow will be scattered throughout on suitable wet sites, hazel being restricted to the most fertile sites. Conifers will be planted in groups and in drifts on areas well away from important spawning burns.

Average stocking densities of 1,100 stems per ha<sup>-1</sup> for native broadleaf's and 2,300 stems per ha<sup>-1</sup> for native conifers are envisaged. Succession of existing semi-natural woodlands and areas of regeneration will be encouraged by leaving a radius of approximately 100 metres unplanted.

### **2.2.6 Planting Layout.**

The project will be laid out in a effort to blend into and enhance, rather than detract from the landscape. Watercourses have been identified and will form a major part of the layout by breaking up the woodland using their natural lines. Rides required to further break up the woodland, will be carefully laid out by following natural ground contours, straight lines being avoided at all times.

Watercourses will be protected by creating and maintaining varying buffer strips of 20 metres minimum width either side. Corridor effects will be mitigated by the feathering in of trees at strategic points along embankments, this will create dapple shade effects and serve to enhance aquatic habitat diversity. These dimensions will increase downstream to approximately 40-50 metres or more whilst encompassing old field sites, ruins, and existing semi-natural woodland remnants. A varied and substantial, unplanted loch-side margin will be maintained to accentuate interesting features and shoreline shape. The top boundary line will be laid out using the natural attributes of the landscape, coming down below outcrops and protruding up into basins, thus creating a smooth flowing line in harmony with the particular area.

### **2.2.7 Fertilising.**

In order to give the trees an initial boost, P.K. fertiliser will be hand applied to trees during mid-summer at a dosage of 100 kg/ha<sup>1</sup> for broadleaf's and 150 kg/ha<sup>1</sup>. for native conifers. Particular care will be taken to protect watercourses and wet areas by strict adherence to F.A. guidelines.

### **2.2.8 Weed Control.**

Afforested areas will not be treated with herbicides. Unplanted margins, buffer-strips, archaeological sites will be maintained by periodic mowing, strimming and by hand as appropriate.

### **2.2.9 Protection (Deer management plan).**

In the early stages of woodland development, deer which access the site will have to be removed. To this end two deer jumps will be constructed at suitable points along the southern fenceline, thus facilitating self-egression.

Deer stocking densities within the Eriboll estate are presently low, therefore it is not envisaged that deer will constitute a problem. Management strategies will however be employed to ensure that unacceptable grazing pressure be contained both on-site and at Arnaboll through a regime of out of season selective culls, whereby a nominated individual will be nominated and authorised as controllers (in agreement with the R.D.C.), with the additional responsibility of periodic fenceline inspection.

The layout of the woodland has taken the longer term deer population into consideration. It is evident from other woodland areas throughout the Highlands, that larger, prominent, unplanted areas will serve as deer lawns, valuable open spaces for other flora and fauna and can be utilised as deer control sites.

As the woodland matures and is opened up, red, roe and sika deer will undoubtedly colonise but, with careful management they should become an asset rather than an issue, their population will be controlled to this end.

## **SECTION 3 : Environmental Impact Assessment.**

### **3.1.0 Terms of Reference.**

3.1.1 Interim planting proposals were submitted to the Forestry Authority in August 1993 for the afforestation of a 749 ha. area situated between Arnaboll and Allt an Locha Chrocaich on the east facing slopes of Loch Hope, N.W. Sutherland (see 4.1.0). It was envisaged that 432 ha. of broadleaf's at stocking density 1800 /ha. and 317 ha. of predominantly non-indigenous conifers at 2300/ha be planted.

3.1.2 In view of the sensitivity and scale of the project the FA requested that an E.I.A. be conducted on the legislative basis S.I. 1988 No.1207 Environmental Assessment (Afforestation Regulations) developed from the Directive of the Council of E.C. No. 85/337.

An E.I.A. is the first stage of the consultation process for planting approval and serves as a decision making framework by identifying the relative impact of the proposal. The procedure is designed to involve statutory and advisory bodies as well as individual members of the public in an open analytical process, thereby avoiding unnecessary environmental degradation (by incorporating appropriate mitigating measures into the proposal) and public disputes.

3.1.3 A planting proposal comprising 603.8 ha<sup>-1</sup>. of mainly non-indigenous conifers was previously submitted for entry into the F.G.S. and, accepted by the F.C. in November 1987, the approval has subsequently expired .

3.1.4 In accordance with requirements an E.I.A was commissioned by Highland Woodlands and conducted by J. Rathey between July and September 1994. The proposal was subsequently modified as a result of the ongoing E.I.A. procedure.



3.1.5 The following statutory bodies and interested parties have been consulted and were of assistance in conducting the E.I.A., their views and recommendations being taken into consideration when modifying the scheme to an acceptable form;

Scottish Office Agriculture & Fisheries Dept;  
Highland River Purification Board;  
Scottish Natural Heritage;  
Highland Regional Council Planning Dept;  
Highland Regional Council Archaeology Dept;  
Forestry Authority;  
Red Deer Commission;  
Caithness & Sutherland Enterprise Company;  
Royal Society for the Protection of Birds;  
Hope and Pollar Salmon Fishing Assoc.

### 3.2.0 **Base Line Information.**

A baseline study was undertaken from mid July to mid August 1994 in order to determine existence and composition of flora species within the proposed afforestation scheme area.

To this aim 15 transect locations were selected semi-randomly throughout the study area prior to access, using a grid system and table of random numbers. The transects varied in length from 200 to 700 m<sup>-1</sup>. depending on the accessibility of the area and time constraints. At intervals of 30 m<sup>-1</sup>. a semi-quantitative assessment of ground cover was conducted using a 1m<sup>-2</sup> quadrant (refer to 4.11.0). Plant species not found within the quadrant but on or near the transect were also recorded separately (see 4.8.0) along with sighting of animal species.

A survey of animal species, composition and abundance was not undertaken, as a comprehensive assessment would require full-time, year-round observations. Animal species when observed, were however recorded during the course of the vegetation and soil survey.

Soil type was determined at 50 sites within the area by excavation with a spade, through the substrate to a maximum depth of 70 cm<sup>1</sup>., determined by the depth of soil over bedrock or the degree of induration. On excavation, observation of the soil horizons was used to determine the soil type. Due to time constraints, other areas were determined on the basis of vegetation cover (refer to 4.6.0).

Two consecutive days were spent to cover the study area on foot, locating and identifying previously unrecorded archaeological sites, an archaeologist from the H.R.C. being present. A comprehensive desktop appraisal using aerial photographs was then carried out.

Visual appraisal was conducted to estimate the impact or intrusion of the afforestation scheme. Panoramic photos were taken from strategic viewpoints / stopping places along the A. 838 (between Loch Maoyally and Hope) and the A. 836 between Hope and Altnaharra. Transparent overlay techniques were then applied to present a projected appearance and assist in landscape design (refer to 4.10.0-7).

### **3.2.1 Landscape.**

The intended afforestation scheme site lies on the east-facing slopes of Loch Hope in NW Sutherland and has been described in previous W.G.S. applications as "one of the most scenic areas of inland Sutherland" <sup>1</sup>. Although no statutory designation of the area applies the site is located at the immediate western boundary of the Kyle of Tongue N.S.A. and described as providing a "pleasing background to the loch and an attractive backdrop to the more rugged slopes of Ben Hope" (Turner '87) <sup>2</sup>.

Archaeological evidence suggests that the site has been populated by small pastoral communities since the Bronze Age. Over centuries the existing and extensive native woodlands were gradually diminished as the demand for fuel, timber, and grazing increased. Deforestation probably reached its peak during the 16th and 17th centuries. Roy's Map of the 1780's indicates the existence of sizeable pre-clearance settlements and that the extent of woodland covered was only marginally greater than remains today.

Old field and drainage systems illustrate how man has systematically aspired to harness and modify the local environment in order to satisfy his needs. The present habitat, ecosystem and landscape comprising of extensive, open, poor and unproductive moorland are a lucid reflection of this, and should not be erroneously assumed to be of natural consequence.

The scale of a landscape is related to relative and absolute size and has a major bearing on perception. The visible landscape increases with scale and is a function of distance and the elevation of the viewpoint. The proposed site is highly visible from the A.836 between Hope and Altnaharra, which runs along the western shoreline of Loch Hope. The distance from the roadside viewpoints varies from 0.5 to 1.5 km, elevation is low and views of the opposite shoreline are restricted in its entirety due to the shoreline shape, geomorphological features and length.. The landscape scale can be categorised as being small to moderate at the northern end of the site (refer to 10.4.0), large in the middle and southern regions (refer to 10.4.0-6.0).

The landscape comprises a matrix of acidic dwarf-shrub heathland, mire, semi-improved acidic grassland and flushed peatland slope and plains, dissected by numerous streams and ditches which flow into Loch Hope. Patches of remnant semi-natural woodland form corridors along the most significant watercourses and along lengths of the loch shoreline, below Salachhaidh, at Creag na h'Urbhaird and on the lower slopes and shoreline of Creag Bhreag.

Characteristic elements of the landscape include geomorphological features at Creag na h-Urbhaird and Creag Bhreag which add attraction and interest to the contrasting hummocks and rolling slopes. Areas of grassland, heather, bracken and flushing provide a patchwork of landscape colour and tone ranging from light greens through purple and browns.

### **3.2.2 Climate.**

The climate of the study area is cool and wet. Precipitation derives from depressions formed over the Atlantic. Data recorded at Hope G.R. NC474603 showed that total rainfall for 1993 was over 2,400 m.m. and typifies the annual mean for this area. The mean annual temperature lies above 6 °C. No estimates as to present and actual levels of evapotranspiration were forthcoming.

### 3.2.3 Soils / Geology

The site of the proposed woodlands scheme has been classified by M.L.U.R.I. (refer to 4.3.0), and is characterised by peat, peaty podzols and peaty gleys, ranging from undulating lowlands to uplands, moderately rocky, bouldery hummocks, rocky valley and slope moraines. Major geological landforms and parent materials being derived from micaceous schists, gneisses, granulites and quartzites of the moine series which are associated with low background phosphorous loads and the natural acidity of local waters within the catchment.

The soil (refer to 4.5.0 and 4.6.0) was found to be predominantly comprised of peaty podzols of the Arkaig association (covering some 2,121 km<sup>2</sup> this is the most extensive soil unit in N.Scotland) with an indurated or gleyed horizon above a weak ironpan. Peaty gleys occurred in basins with peaty rankers occurring locally on basement rock in exposed sites. Upper slopes were often heavily hagged with evidence of erosion by solifluction, wind and water.

Apart from localised dystrophic flushes and wet heath areas most ground was relatively well drained. It is suspected that during periods of high precipitation drainage may be impeded by impervious bedrock or indurated strata, resulting in increased waterlogging and overland run off.

Several sites within the study area showed evidence of improvement for agriculture, namely at Badvoer, Salachaidh and at Arnaboll. Comprising B horizon of sandy/silty loam from 10 to 30 cm<sup>-1</sup>. in depth and only moderately stony.

### 3.2.4 Land Use / Classification.

Land Capability Classification can be used objectively to indicate the range of possible usage's and as an aid in land-use planning. It encompasses such factors as climate, gradient, soil, exposure, wetness and other limiting qualities in determining suitability.

The M.L.U.R.I. survey (1982) indicates that land to the S.S.W. of the proposed woodlands site is capable for use as improved grazing and classification 5.3, wetness and slope being the main limiting factors (refer to 4.7.0).

The remaining areas are classified as 6.3 and capability for use only as rough grazing. Being of low productivity, limitations of this classification include wetness, topography and climate which preclude improvements.

Evidence of past land improvement for agricultural purposes can be identified at several sites where visible signs of past rig and furrow cultivation are apparent. Small scale peat cutting was practised throughout the study area until at least 1946 but there are no indications of recent activity.

Present land use comprises of the limited grazing of sheep at extremely low stocking density. In view of the distance from Eriboll Farm and the generally low productivity of the land, no agricultural implications are to be expected from the scheme.

Indicative Forest Strategy provides a guideline which identifies land use constraints with regards to forestry, for use as a broad-based regional planning guide. The 'sensitivity' of an area is assessed in terms of preference, for regional classification into zones. Classification is conducted by sieve analysis, whereby constraints encompass landscape, environmental, recreational, communication and catchment factors.

The H.R.C. I.F.S has identified the proposed woodland scheme site as 'sensitive' in view of landscape considerations, indicating that only a limited range of forestry types would be acceptable. "Where planting or natural regeneration is appropriate it should be primarily for conservation or amenity purposes and its design and species content should reflect this" (R.Patton, 1994)<sup>3</sup>.



### 3.2.5 Material Assets

A number of interesting archaeological sites are located within the study area and are displayed on 'Roy's map' of the 1780's and recent O.S. maps of the region.

These include two large peat and stone enclosures at Salachaidh of unknown period, and three C18 to C19 walled enclosures at Badvoer. Other sites of substantial archaeological interest are located at Arnaboll outwith the proposed development site.

An on-sight appraisal which was undertaken over a period of two consecutive days in August was hindered by rank bracken. Subsequent desktop appraisal of aerial photographs was conducted by the H.R.C Archaeology Dept. but was hampered by equipment deficiencies. However, on the lower slopes and shoreline of Loch Hope a number of potentially interesting archaeological sites (refer to 4.11.0) were identified.

These are situated;

- i) Between Allt Loch na Creige Riabhaich and Allt an locha Chrocaich, adjacent to the river Strathmore at the southern end of the scheme.
- ii) In the vicinity of Allt bad a Mheoir adjacent to the Loch Hope shoreline.
- iii) In an area which shows signs of land improvement, between Allt Bhreraig (previously mentioned) and to the north of Allt a Gharbh-chnuic. At Allt Bhreraig the possible site of at least one bronze age hut circles has been located.
- iv) In the vicinity of Allt nan Gobhar and, an adjacent unnamed watercourse to the south.

A comprehensive desktop re-assessment of the study area has been undertaken and indicates the past existence of sizeable communities, it is envisaged that the H.R.C be notified if further unknown remnants are identified during ground preparation work.

### **3.2.6 Flora.**

Vegetation within the surveyed area essentially involved three stages, closed vegetation to patchy vegetation and bare rock comprising Atlantic heath and moorland of the damp-wet type interspersed with intimate mosaics of carex /molinea /sphagneto grasslands, (refer to 4.9.0).

In 1975 the Nature Conservancy Council (N.C.C.) commissioned the University of Lancaster to create a classification system for all British vegetation communities of natural, semi-natural and artificial habitats. Each community is

characterised by an identifying code and number, according to the dominant vegetation species, i.e. M17.

'Match' ver. 1.2 -software developed by Lancaster University, was utilised to statistically analyse transect data. Subsequent reference of appropriate literature seems to confirm identification of relevant plant communities within the study area (refer to 4.12.0).

The following N.V.C communities were identified;

M15 - *Scirpus cespitosus-Erica tetralix* wet heath.

This plant community is well represented in the NW Highlands of Scotland occurring almost at sea level in areas with annual precipitation above 1600 mm and at least 180 wet days per yr<sup>-1</sup> (Radcliffe, 1968)<sup>4</sup> and almost no potential water deficit. Soils are generally moist, acidic, better drained and thinner oligotrophic peats with a surface pH between 4-5. Succession generally results in the establishment of *Pinus sylvestris* and *Betula pubescens*.

This community is of International importance and as such, in 1992 69.1 kha<sup>-1</sup> were represented in S.S.S.I. in the U.K. with 46.3 kha<sup>-1</sup> of the total in N.Scotland.

M17 - *Scirpus cespitosus-Eriophorum vaginatum* blanket mire.

Characteristic blanket bog of more oceanic parts of Britain, this is essentially a community of lower altitudes. It is found in areas of over 2,000 m.m. rainfall per annum, and occurs extensively on waterlogged ombrogenous peat that has accumulated in a persistently humid climate.

This community persists as climax vegetation, and is of International importance. In 1992, 51.5 kha<sup>-1</sup> were protected within S.S.S.I.'s in the U.K., 46.3 kha<sup>-1</sup> of which are in N.Scotland.

M25 - *Molinea caerulea*-*Potentilla erecta* mire.

A community which is common and widespread in areas with a cooler but relatively mild climate, becoming more local in the NW Scottish Highlands. It is associated with, well aerated acid to neutral, peaty and peaty mineral soils on gently sloping grounds, below 200 m. A.S.L.

This community extends to fringes of ombrogenous bogs and areas marked by seepage zones and flushed margins, intermediate between waterlogged and excessively drained soils. Both climate and grazing influences this community and probably accounts for the abundance of *Molinea*. Succession to scrub and woodlands can be rapid, the most common species being *Betula pubescens* and *Salix cinerea*.

Of International importance, in 1992 20.3 kha<sup>-1</sup> of this community was protected within S.S.S.I.'s in the UK, with 1.5 kha<sup>-1</sup> in N.Scotland.

A comprehensive copy of all transect data obtained within the study area, is available for viewing, on request, at the Forestry Commission offices in Dingwall.

The botanical interest of the area is compounded by existing broadleaf woodlands along the numerous watercourses and along the shoreline of Loch Hope. These comprise predominantly of birch and rowan, with some goat willow, hazel, alder and aspen. Three locations (see 4.12.0) are of considerable merit and conservation value, one of which had previously been rated as a potential S.S.S.I.

These are;

**Arnaboll wood (NC45/55: 467586)** A remnant of ancient woodland indicated on the Roy's map of the 1780's and believed to date back to the end of the last Ice readvance. This birch/rowan woodlands with some old hazels was rated as a potential S.S.S.I. of Grade IV. rank in a 1979-79 summary, but was subsequently reclassified to Grade V. in July 1984 due to considerable deterioration of areas of birch/rowan, resulting from the consequences of advanced ageing and restricted regeneration. There are however sections of the flushed shoreline and adjacent woodlands which are considered to be of unquestionable S.S.S.I. status, but their total area is considered too small to warrant such status.



**Greag na h-Urbhaird (NC45/55: 466563)** Birch/rowan woodland slopes adjacent to the Loch Hope shoreline with birch/aspen crags at the southern end of the site.

**Creag Bhreag woodland (NC45/55: 456532)** A birch/rowan/aspen woodland on an east-facing granulate crag.

### 3.2.7 Fauna.

A period of six weeks was spent within the study area during July and August 1994, but mainly confined to the rough grazing habitat with only occasional excursions to the Loch Hope shoreline. An assessment of animal populations or communities, within the divers habitat range was not undertaken as this would require full-time, year-round observations.

These habitats were characterised by native semi-natural broadleaf woodlands, shoreline, aquatic environments, gullies and crags as well as rough grazing which was predominant. Animal species when observed, were recorded during the course of the vegetation and soil survey (refer to 4.8.1).

#### Birds.

No detailed ornithological surveys of the area were available, however the R.S.P.B. was able to supply some general information related to special species and rare bird monitoring surveys (Crooke, 1994)<sup>5</sup> which is summarised.

The study area is typical of north west Sutherland moorlands as it supports a variety of moorland breeding birds. In addition boggy peatland, flushes, lochans, lochs and the various watercourses are the habitat of various species such as the golden plover (*Pluvialis apricaria*), snipe (*Capella gallinago*), common sandpiper (*Actitis hypoleucos*), dipper (*Cinclus cinclus*) and grey wagtails (*Motacilla alba*) some of which were recorded during the baseline study. Breeding greenshanks (*Tringa nebularia*) are also present and the area is considered to be a desirable habitat for migratory waders. A breeding pair of black-throated divers (*Gavia artica*) are reported to frequent Loch Hope and were sighted during the study period in the vicinity of Arnaboll. Breeding success has been reportedly disappointing and associated with nest failures due to fluctuation in water levels.

The area of the proposed woodlands scheme is also described by Crooke (1994) to be " of interest to birds of prey ". It is known that peregrine falcons (*Falco peregrinus*) occupy a traditional nest site adjacent to Arnaboll. At least one, possibly, two breeding pairs of merlin are to be found within the proposed planting site. Furthermore, " buzzard (*Buteo buteo*), kestrel (*Falco tinnunculus*) and sparrowhawk (*Cervus elaphus*) have also been observed in the area and probably all breed". The area also "forms part of the home range of a pair of golden eagles".

Low numbers of red grouse (*Lagopus lagopus*), although in patchy concentrations were observed within the study area and are associated with areas of better heather. Ring ouzel (*Turdus torquatus*) are associated with the steeper areas and rocky outcrops.

Most of these birds are listed on Schedule 1 of the Wildlife and Countryside Act (1981) and/or on the E.C. Directive on the Conservation of Wild Birds (Directive 79/409/EC) Annex 1. They are therefore protected by law as a species requiring special conservation measures.

The R.S.P.B. has often expressed concern as to the loss of open moorland hunting areas of birds of prey to commercial coniferous forestry. Watson et al. (1987)<sup>6</sup> have reported how such losses can result in a lowering of productivity, failure to breed successfully, and eventual loss of adults. Sensitively planned reforestation with native species is generally welcomed as it redresses the ecological degradation of native woodland cover.

### Deer.

Estimates of the red deer population conducted by the Red Deer Commission indicate that stocking densities are very low within the study area but a group of 20 stags were sighted near and north of Arnaboll. Reliable local sources report that sika deer have been clandestinely introduced in the vicinity of Hope, presumably to enhance the sporting value of nearby estates.

## Salmonoids.

Loch Hope is a designated Salmonoid water in terms of E.C. Directive (78/659/EEC) on fresh-water quality. It is of considerable importance to the sustainability of local and regional fish stocks including sea-trout and salmon. Sport fishing is important to the local community as a source of income and a cultural heritage.

The majority of watercourses situated within the catchment area are important as seatrout spawning grounds. therefore careful consideration towards their protection is essential. An assessment of their significance to the breeding fish populations was undertaken by representatives of the Hope and Pollar Salmon Fishing Association, during December 1993 (see 4.10.0). It was concluded that watercourses situated between Allt nan Gobhar and Arnaboll are of "limited value to fish" whereas all others are considered to be "of significant value, especially to seatrout" (P.S. Murch, 1993)<sup>7</sup>.

## Insects.

Little is known of insect communities within the study area. *Cordulegaster boltonii* (Golden-ringed dragon-fly) was observed and recorded within the study site. Although occurring relatively commonly within the Sutherland region, they are of considerable importance and conservation interest when viewed in a European context . This arises from the fact that most suitable continental peatland breeding habitats have been lost or modified to such an extent, that European populations are increasingly unsustainable and in decline. Red Ants were also observed, they are considered to be uncommon in N.W. Sutherland and prone to disturbance.

### **3.3.0 Value Judgement Disclaimer.**

3.3.1 It must be stated that prognosis and quantitative impact statements are subjective and vary from site to site being dependent on a variety of biotic and abiotic factors. The author attempts to provide value judgements but disclaims any liability for estimation of change or unforeseen environmental consequences which may arise from the proposed scheme.

3.4.0 **Likely and Major Impacts.**

3.4.1 Likely and major impacts were identified and quantified, employing a modified 'Leopold Matrix' system. Quantification relies on an arbitrary scale of 1 to 5 in order of magnitude.

### **3.5.0 Initial Ground Preparation/Planting Stage.**

#### **3.5.1 Fencing.**

Apart from the initial short-term disturbance of soil, flora and fauna as a result of the fencing operation, fencing posts may constitute a visual intrusion especially apparent on the north ends of the Loch side and along the road-track between Eriboll and Cashel Dhu, which to a large extent comprises the upper planting boundary at the north end of the scheme.

Red deer and sheep will in effect be excluded from grazing pastures. This will be detrimental for ground and lower-herb layer floral species, as reduced grazing pressure will result in the proliferation of vegetation. Many lower and less competitive species being shaded-out will inevitably experience local population decline.

In summer red deer stags generally reside above 500 m. but in winter they move downhill and have a tendency to frequent the better grazing areas. A fenceline of ~ 10 km<sup>-1</sup> would impair the movement of deer to the lowland shelter and grazing areas and may result in dramatically increased grazing pressure where access is maintained. Elevated levels of deer mortality deer may occur due to a reduction in accessible grazing areas.

Stocking densities of grazing and browsing animals will increase as a result of displacement and further deterioration of the Arnaboll wood site may occur, as a consequence of reduced natural regeneration. An increase in sheep stocking densities would inevitably result in a similar impact, therefore management steps must be taken to maintain sustainable proportions.

Deer fencing may also constitute a high risk to larger mammals and birds which could get trapped or suffer injury. Of particular concern is the collision of larger hunting birds of prey, " there may be a high risk of eagles colliding with forestry fences during hunting" <sup>8</sup>.

### **3.5.2 Recreational Access.**

During the whole of the study period only two persons were seen to access the study area for recreational purposes. A public right of way does exist between Eriboll estate and Cashel Dhu traversing the proposed planting site, formally a public road there are presently signs of degradation. It is envisaged that materials and plant be transported along this access route. During the initial ground preparation and planting stages this may result in an insignificant degree of hindrance. Subsequent access will be maintained by the provision of gates and styles.

Access will be maintained along the Loch Hope shoreline between Arnaboll and Cashel Dhu, following firm ground along the extensive unplanted margins of the Loch.

### **3.5.3 Mounding.**

Although mounding techniques have the advantage that initial ground preparation such as artificial drainage channels and deep ploughing can be avoided, such practices will definitely have a local impact on soil structure and hydrology. Resulting in an increase in erosion, sediment load to local water courses and airborne particulates.

When continual mechanised mounding by L.G.P. vehicles is practised, this will result in increased local soil compaction and erosion, impact to fauna as a result of noise disturbance and the local destruction of flora. These impacts may be compounded when wet conditions reduce trafficability and increase poaching risk, especially on steeper slopes. Increased human activity on the hillside during the initial phase will also cause considerable disturbance to fauna, especially to sensitive species of birds, if practised during the breeding or mating seasons (mid March to mid July). This may result in population decline or displacement if prolonged.

Initially disturbance to flora will be substantial but it is believed that areas impacted by mechanical means will soon recover. Raised mounding sites may serve as suitable and important sites for the establishment of less competitive ground-layer plant species, which may otherwise decline as the vegetation becomes more prolific as a consequence of increased nutrient uptake and reduced grazing pressure. Over

a longer time frame, effects of the initial disturbance may prove to be beneficial for some species and a full recovery of vegetation can be expected until they are shaded out by the oncoming trees.

Visual intrusion is not expected from a distant viewpoint but the close up view will be effected, although to a much lesser extent than with traditional ploughing techniques.

The storage of drums and fuel on site and, the refuelling process itself, represent major potential sources of impact to soil and watercourses.

#### **3.5.4 Fertiliser Application.**

Fertiliser application is necessary for the successful establishment of woodlands in nutrient poor soils. Some leaching from peat is inevitable as it consists mainly of un-decomposed organic matter and as such has limited cation exchange capacity to fix the applied nutrients.

"Phosphorous loss of up to 60% of application has been reported" (C.F. Mason, 1991)<sup>9</sup>. Large scale fertiliser usage may result in diffuse or dry deposition of phosphorous, the eutrophication of water courses and modification of aquatic fauna and flora composition, although in dystrophic waters this may lead to a beneficial increase in primary productivity.

Larger, lentic water-bodies may experience modification to species structure, often characterised by algae being replaced by cyanophytes (blue-green algae) or an increase in phyto-/zooplankton abundance and turbidity. Catchment lakes may be affected by large short-term increases in PO<sub>4</sub> levels, especially if application coincides with other agricultural usage within the catchment areas. The H.R.P.B. have advised that the use of phosphate fertiliser may result in the Board's E.Q.S. threshold being surpassed and have expressed concern that nutrient dosage and application guidelines be given high priority and adhered to.

The timing of fertiliser application is most important and should not coincide with diffuse inputs from agricultural or forestry sources within the catchment area. Mason<sup>10</sup> describes how, "soluble phosphate input would have a greater impact when entering the catchment store in springtime when phytoplankton growth is at its

greatest" and how "Anoxic conditions may develop and lead to a decline in commercially important fish stocks" such as seatrout and salmon on which segments of the local sporting and tourist industries rely for a significant proportion of their income.

The degree and longevity of impact is influenced by factors such as the applied amount, total area of the catchment basin, rainfall, throughflow and flushing-rate of the catchment store.

Localised modification of soil nutrient status and pH can be expected when PK fertiliser is applied. Flora initially exhibit proliferation and increased productivity in response to nutrient input uptake.

#### 3.5.5 Fauna.

Radcliffe (1980) <sup>11</sup>, describes how faunal changes often run in parallel to those of vegetation, the transition of openland to scrub to thicket establishment being regarded as a productive phase for wildlife. Increases in abundance of species such as short-tailed field voles, deer (although these are usually controlled to reduce browse damage) and insect communities are recorded as grass luxuriance and shrub cover increases, the former attracting predators such as the hen harrier and owls. Colonisation and establishment by woodland birds such as willow and wood warbler flycatcher, black grouse and the rare redwing (have been recorded breeding in birch woodlands nearby) is to be expected.

It is essential for the successful spawning and hatching of Salmenidae, that siltation of watercourses does not result from ground preparation. Gravel beds should remain free of sand, silt and clay which could cause impaction, prevent the cutting of redds, substantially reduce the flow of oxygenated water through the gravel and deny juveniles refuge from predation.



3.5.6

<b>Impact Matrix - Initial Ground Preparation / Planting Stage.</b>								<b>+ / -</b>
<b>Likely and Major Impacts.</b>	<b>S</b> <b>i</b> <b>t</b> <b>e</b> <b>a</b> <b>c</b> <b>c</b> <b>e</b> <b>s</b> <b>s</b>	<b>F</b> <b>e</b> <b>n</b> <b>c</b> <b>i</b> <b>n</b> <b>g</b>	<b>M</b> <b>o</b> <b>u</b> <b>n</b> <b>d</b> <b>i</b> <b>n</b> <b>g</b>	<b>P</b> <b>l</b> <b>a</b> <b>n</b> <b>t</b> <b>i</b> <b>n</b> <b>g</b>	<b>F</b> <b>e</b> <b>r</b> <b>t</b> <b>i</b> <b>l</b> <b>i</b> <b>s</b> <b>e</b> <b>r</b>	<b>W</b> <b>e</b> <b>e</b> <b>d</b> <b>i</b> <b>n</b> <b>g</b>		<b>N</b> <b>E</b> <b>T</b>  <b>I</b> <b>M</b> <b>P</b> <b>A</b> <b>C</b> <b>T</b>
Likelihood of Impact └─── 2/5 └─── Severity								
<b>Water</b>	<b>2/1</b>	<b>2/2</b>	<b>4/3</b>	<b>2/1</b>	<b>4/3</b>	<b>2/1</b>		-
Sediment	2/2	3/2	4/3		2/1	2/2		-
Turbidity	1/1	3/1	2/3		3/1	1/1		-
Ph					2/2			+ / -
Phosphorous		2/1			4/4			+ / -
Hydrology	3/2	4/2	3/3	2/1		1/1		-
<b>Soil</b>	<b>5/3</b>	<b>4/1</b>	<b>5/3</b>	<b>3/2</b>	<b>3/2</b>	<b>3/1</b>		-
Compaction	3/3	5/1	5/3	2/1	2/2	1/1		-
pH				2/2	3/2			+ / -
Structure	5/2	2/1	5/3	1/1		1/1		-
Erosion	5/3	4/2	5/3	3/2		3/1		-
<b>Air</b>	<b>4/1</b>	<b>4/3</b>	<b>5/2</b>	<b>2/1</b>	<b>4/1</b>	<b>3/1</b>		-
Particulates	4/1	4/3	5/2	2/1	4/1	3/1		-
<b>Human</b>	<b>3/1</b>	<b>4/3</b>	<b>4/3</b>	<b>4/3</b>	<b>3/1</b>	<b>4/2</b>		+ / -
Economic	3/2	4/3	3/1	4/2	4/1	4/1		+
Visual Impact	3/1	4/3	4/3	4/3				-
distant	3/1	3/2	3/2	4/2				+ / -
close	4/1	4/3	5/4	5/3	1/1			-
Access Rec.	5/3	5/3	3/2	3/2				+ / -
Material Assets	5/2	3/4	5/4	5/4	3/2	3/2		-
<b>Flora</b>	<b>5/2</b>	<b>4/2</b>	<b>5/3</b>	<b>4/3</b>	<b>5/4</b>	<b>3/2</b>		+ / -
Wetland	5/2	4/1	5/3	3/2	5/4	2/1		+ / -
Woodland	2/1	3/1	2/1	3/2	3/3	2/1		+ / -
Openland	5/2	4/2	5/3	5/4	5/4	3/2		+ / -
<b>Fauna</b>	<b>4/2</b>	<b>4/2</b>	<b>5/3</b>	<b>5/3</b>	<b>4/3</b>	<b>3/1</b>		+ / -
Woodland mammals	2/1	2/2	3/3	5/4	4/3	2/1		+ / -
Shoreline mammals	1/1	2/1	3/3	2/1	2/1	1/1		+ / -
Openland mammanls	5/2	5/3	3/3	5/3	2/1	2/1		-
Woodland birds	2/1	2/1	3/3	2/3	1/1	1/1		+ / -
Shoreline birds	2/1	2/1	3/2	1/3				+ / -
Openland birds	5/2	5/2	5/4	4/3	3/2	3/1		+ / -
Amphibians	3/2	3/1	5/3	3/3	4/3	2/1		-
Insects	2/1	1/1	5/3	5/3	4/3	4/3		+ / -

### 3.5.7 Mitigating Measures.

Ground preparation of inaccessible or sensitive areas, should be undertaken by hand mounding or screening where practicable. Compaction and erosion of soil resulting from L.G.P. machines accessing the site, should be minimised by alternating routes and following areas of hard ground. The density of mounding centres should be varied in order to provide the basis of an unevenly structured woodlands and to avoid unsightly linear patterns which may otherwise be apparent upon tree establishment.

In order to minimise the possibility of nutrient enrichment to watercourses and its associated effects it is recommended that application of fertilisers is undertaken by hand and is reduced to 100 kg $ha^{-1}$  for native broadleaf and a maximum of 150 kg $ha^{-1}$  for the conifer blocks, applied during mid-summer. Spillage and deposition near flushed wet ground or water courses should be avoided at all times. Application should not be undertaken during periods of adverse weather conditions such as heavy winds and rain. Strict adherence to F.C. guidelines should be practised at all times.

Watercourses should be protected from siltation and nutrient enrichment by the provision of unplanted bufferstrips along ditches, drains and open pools with a minimum of 10 metres either side. For streams it is envisaged that buffer strips of a least 20 metres width be established. Corridor effects should be mitigated by the feathering in of trees at strategic points along embankments, thereby creating dapple shade effects and enhancing aquatic habitat diversity. Where water courses approach the lochside, unplanted margin width should be increased to approximately 40-50 metres.

Visual intrusion resulting from fencing lines may be reduced in the short-term by using treated posts which are light green in colour and, are less visible from a distance. The area is adequately broken up for fencing lines to be hidden or laid out harmoniously with landform contours, seeking where practicable to avoid a geometrical layout in favour of flowing lines.

As the fencing boundary will exclude deer and sheep from the plantation site and, may result in a dramatic increase in grazing pressure to ecologically important sites. Arnaboll wood is increasingly at risk of further decline, due to advanced ageing and restricted regeneration. Management steps should be undertaken to address

this, whilst stocking densities of grazing and browsing animals must be maintained at sustainable proportions.

The applicant has ownership rights to the Arnaboll site and may achieve this by restricting sheep access and grazing period. In the case of deer that are less readily manipulated, a regime of selective culls and/or diversionary feeding may be undertaken until the newly planted trees are established and the area is reopened. When properly managed other long-term benefits such as stock improvement may also be achieved.

Deer fencing constitutes a high risk of collision to hunting birds of prey such as the golden eagle, efforts should be undertaken to increase visibility of the upper fence lines. The R.S.P.B. suggests that this may be achieved by attaching bunches of heather, this is acceptable to the applicant. They have offered further professional advice if necessary.

Interesting archaeological sites have been located and should be left unplanted to within 35 metres, be maintained and incorporated into open spaces. Where practicable, rides or footpaths should be interlinked with sites to allow easy public access and serve as wildlife corridors.

Enclosures at Salachaid should be safeguarded by modifying the upper boundary fenceline. Thus, remaining outside the planting area and subject to grazing pressure, will not be affected by planting operations or require preservation management.

Other sites of archaeological interest namely at Badvoer, Allt Bhreaig, between Allt Loch na Creige Riabhaich and Allt an locha Chrocaich, Allt bad a Mheoir, Allt a Gharbh-chnuic and Allt nan Gobhar should be incorporated into extensive unplanted margins along the Loch Hope shoreline. Management steps such as periodic mowing or strimming being undertaken to remove regeneration.

Ecologically interesting areas often coincide with sites of previous land improvement/modification or archaeological interest. These can be easily incorporated into the unplanted shoreline margins. The width of unplanted margin should be varied to enable the sustainable representation of the diverse habitat types and ecological diversity as well as adding accentuation and interest to the shoreline features and shape. Areas of dystrophic flush, peat, heather and

grasslands should be left unplanted and/or incorporated into open spaces and deer lawns, care being taken that the geometric orientation and dimensions are adequate to provide viable animal habitats.

In order to eliminate boundary effects, treelines should be feathered and varied with conifers planted strategically to provide an aesthetic quality, and colour variation. Areas of geomorphological interest, such as crags and rocky outcrops should be accentuated by careful planting, trees being feathered and held back a reasonable distance from features to provide a more natural appearance.

Potential impacts of fuel-oil spillage should be mitigated by the provision of adequately bunded, plastic lined storage facilities. Contractors ensuring that oil-tanks and loose drums are adequately secured to prevent accidental or malicious spillage. An appropriate transfer hose should be utilised during refuelling operations.

### **3.6.0 Thicket Stage.**

#### **3.6.1 Thinning**

The general composition of the woodlands scheme with a reduced commercial conifer element of only 20% is such that thinning operations are not expected to be of necessity, so mitigating any potential impacts. Broadleaf elements will be subject to natural factors such as browsing, dominance and overshadowing and are expected to develop an open canopy layer providing some potential for the establishment of understorey and herb layer flora.

#### **3.6.2 Secondary Fertiliser Application.**

The impact of fertiliser enrichment has been discussed in the previous section see 10.5.0

#### **3.6.3 Hydrology.**

An increase in evapotranspiration and interception rates can be expected as grassland and moorland is replaced by trees. This is likely to result in localised reductions to run-off, ground through-flow and a lowering of the water table. In view of the regional and local climatic conditions experienced, and with regard to the size of the Loch Hope catchment area (approx. 210 km<sup>2</sup>). Impacts resulting from the proposed afforestation scheme are expected to be of very localised significance.

Calder and Newson (1980)<sup>12</sup> have predicted a 20% reduction of run-off as a result of afforestation in Scotland due to increased interception of precipitation and evapotranspiration rates. The effects of afforestation using deciduous hardwood is considered to be much less than that of conifers. The ground water table can be expected to be lowered and surface run-off reduced, leading to the drying out of previously wet or flushed areas. Wetland species will then tend to be replaced by heath, grassland or woodland species.

#### 3.6.4 Soil Modification.

As the trees become established modification of the soil pH can be expected although "the amount and rate of change of particular plant-dependent soil properties by different species can vary from sight to site" (Wittich, 1972; Howard & Howard 1984)<sup>13</sup>. Some conifer species have a tendency to promote podzolisation, soil acidity and surface mor-humus accumulation.

"Between an unafforested catchment and 30% forest cover, mainly with Sitka Spruce, the pH declines rapidly and both mean sulphate and aluminium concentration of stream water increased with increasing percentage of plantation forest cover within catchments" (Ormerod et al, 1989)<sup>14</sup>. Sutcliff and Hildrew (1989)<sup>15</sup> have described the general phenomenon of invertebrate communities impoverishment related to increases in acidification.

Outcrops of Durness carbonate are situated at Ben Arnaboll outwith the study area, "even small amounts of limestone in a drainage area exert considerable influence in areas which would otherwise be vulnerable (to acidification)" (Henrikson, 1989)<sup>16</sup>. Modifications to the pH status of Loch Hope itself, are not expected as a result of the scheme.

In contrast broadleaf species such as birch and aspen are associated with the de-acidification of soils, the promotion of mull humus formation and development of a soil fauna which may through mechanical intermixing of the soil horizons, result in depodzolification.

#### 3.6.5 Fauna

Initially openland birds will benefit from an increase in insect populations and proliferate. Edges and ecotones will provide additional cover, nesting grounds and shelter. Later as the trees close to form less suitable thicket forest habitats, these communities will become rapidly depleted. Moss (1978)<sup>17</sup> and Moss et al. (1979)<sup>18</sup> have described how canopy-dwelling woodland bird-fauna, especially song birds become the most characteristic group of the resulting habitat.

Wetland and open-ground bird species within the unplanted forest areas and on adjacent moorland outwith the site may, if colonised, experience increases in fox, wildcat or pine martin populations. The associated predation pressure could seriously depress breeding performance. Birds of prey, raptors and carnivorous mammals will benefit from increasing numbers of field mice and voles as well as rabbits.

### 3.6.6 Flora.

As the woodlands tree cover develops, the balance of environmental conditions and habitats are modified and a rapid flora transition from openland species to those of closed woodlands occurs. During this phase of the forest the survival of openland species is dependent on the availability of open unplanted areas such as rides, deer lawns and stream banks. In terms of species variety and composition these areas usually remain impoverished.

### 3.6.7 Visual intrusion

Fences may have a moderate impact from a distance where grazing along the fenceline may lead to an abrupt change of vegetation colour. The trees themselves represent the greatest long-term visual intrusion, the impact of the developing woodland canopy is however subjective and related to personal perception. Visibility is also influenced by a variety of factors such as distance, lighting conditions and atmospheric clarity, which are restrictive in the Hope area as a result of the climate. Long daylight hours in summer and short daylight hours in winter, the annual spread of mist, light rain, snow, sleet and fog with low visibility also complicate matters.

Views of the loch shoreline and surroundings may be obstructed by trees along the right of way between Cashel Dhu and Eriboll, especially at the southern end of the proposed scheme. The generally open character of the area may be replaced by a corridor of trees and restricted viewpoints.



### 3.6.8 **Material Assets**

Unplanted areas within the proposed woodlands scheme site, and which are of ecological interest, will show signs of natural regeneration and succession. If left unmanaged this may result in the local decline of less competitive or shade intolerant plant species and a loss or displacement of openland or ecotonal fauna. Archaeologically significance sites are also subject to natural regeneration and successional processes. The development and penetration of tree and shrub rooting systems, if unmanaged could result in elevated rates of structural and/or material degradation.



Impact Matrix - Thicket Stage.								+ / -
Likely and Major Impacts. Likelihood of Impact └─── 2/5 └─── Severity	T h i n n i n g	W e e d i n g	M o w i n g	F e r t i l i s e r		C o n i f e r	B r o a d l e a f	N E T  I M P A C T
<b>Water</b>	2/1		2/1	4/2		5/2	4/1	-
Sediment	2/1		2/1					-
Turbidity	2/1		2/1					-
Ph				3/1		4/1	2/1	+ / -
Phosphorous				5/3				-
Hydrology	3/1		1/1			5/2	5/1	-
<b>Soil</b>	3/2	2/1	2/2	2/1		4/3	3/2	+ / -
Compaction	3/2	2/1	2/1			2/2	2/2	-
pH				2/1		5/2	3/2	+ / -
Structure			1/2			3/3	3/2	+ / -
Erosion	2/2		2/3	2/1				-
<b>Air</b>	1/1	1/1		3/1				-
Particulates	1/1	1/1		3/1				-
<b>Human</b>	3/1	3/2	2/1	1/1		4/3	5/3	+
Economic	2/1	2/1	2/1	1/1		3/3	3/1	+
Visual Impact	2/1					4/2	5/3	+ / -
distant	1/1					4/1	5/2	+ / -
close	3/2					4/3	5/3	+ / -
Access Rec.	1/1							-
Material Assets	2/1	3/2	3/2					+ / -
<b>Flora</b>	3/2	3/1	3/2	5/3		5/3	5/3	-
Wetland	1/1	1/1		4/3		5/3	3/2	-
Woodland	1/1	1/1	1/1	4/2		5/3	5/4	+
Openland	3/2	3/2	3/2	5/3		5/3	5/4	-
<b>Fauna</b>	4/3	3/1	3/2	2/3		4/2	5/3	+ / -
Woodland mammals	4/3	3/1	2/1	2/3		4/2	4/3	+ / -
Shoreline mammals						1/1	2/1	+ / -
Openland mammanls	4/3	4/1	3/2	2/3		4/2	5/3	+ / -
Woodland birds		3/1	3/1	1/2		5/2	5/3	+
Shoreline birds						1/1	2/1	+ / -
Openland birds	4/4	2/1	3/2	2/3		5/4	5/3	-
Amphibians	1/2	1/1		1/3		4/3	4/2	-
Insects	4/2	1/1		2/3		4/3	5/3	+ / -

### 3.6.10 Mitigating Measures.

Watercourses within the proposed woodlands scheme may be subject to reduced flow rates during periods of low precipitation, resulting from elevated evapotranspiration and interception levels. This could cause an increased turbidity, siltation and drought in severe cases. Wet peats and flushed areas serve as water stores and should be left unplanted.

Watercourses within the catchment system may be exposed to increased acidity through surface run-off and seepage from areas of high density conifer plantation. Rosseland (1986)<sup>19</sup> describes how fish population may decline in acidified waters. This has been attributed to periodic or gradual mortality caused by acid episodes, or to mortality in the susceptible early stages of development and growth, which may mean that the population fails to maintain itself. "This will result in waters where conditions are not overly toxic to adult fish" but "Eggs may be especially sensitive to acidity", (Brown and Sadler, 1989)<sup>20</sup>. During acidic episodes aluminium ions are present in elevated concentrations and can cause gill clogging due to mucus secretion and respiratory interference, " Older fish are much more sensitive to aluminium than eggs and fry, contrasting with the effects of pure acid stress", (Brown and Sadler, 1989)<sup>21</sup>.

Commercially favoured coniferous species such as sitka spruce have been associated with acidification of soils and watercourses and are not considered to be to appropriate to the character and conservation interests of the area. Crooke (1994)<sup>22</sup> of the R.S.P.B. reports that, " We recommend that the conifer element consists of native Scots pine. Indeed to recreate a large area of forest comprised solely of native species is an exiting prospect, particularly in an area which over the centuries has lost much of it's native woodland cover, and has subsequently become ecologically degraded".

It is therefore strongly advised that only native conifer species such as Scot's pine (*Pinus sylvestris*) by utilised, planting being restricted to drier well draining areas away from watercourses and to drier knolls where, feathered and filtered, in clumps or smaller blocks may serve to enhance the knoll and plantation shape. Where conifers planting is envisaged near to watercourses, then these should be intermixed by scattered planting with broadleaves in order to mitigate any acidifying effects.

Openland fauna and flora interests are reduced as the tree cover closes, stream banks, loch shorelines, flushes and peat are to be left unplanted and in sufficient proportions that the various habitat and species variety be maintained.

The open character of the right of way between Cashel Dhu and Eriboll should be upheld by tree planting being held back to within 30 metres of the road, viewpoints being maintained at strategic points. The corridor effect will be mitigated by feathering of trees and considerable variation in the width of unplanted roadside margins, conifers appropriately mixed along the boundary will further enhance visual appeal.

Open unplanted areas and sites of interest will be subject to natural regeneration and if left unmanaged will gradually close as succession takes its course. This may result in the loss of or irreparable damage to archaeologically interesting structures or openland/ecotonal organism communities. It is therefore viewed as important that adequate and appropriate management strategies be developed to assure the periodical removal and control of rank bracken, heather and regeneration. This could include periodical and alternating mowing of deer lawns and rides, limited and selective grazing strategies (this may require additional fencing of larger areas) the cutting back of rank bracken etc. The application of herbicides or muir burning techniques are considered to be ill-advised and inappropriate.

### **3.7.0 Mature Forest/Canopy Stage.**

#### **3.7.1 Extraction of the Commercial Timber Element.**

The composition of the woodlands is such that the small scale extraction of mature timber is not considered to require the construction of haul-out roadways. It is envisaged that timber will be extracted and transported along rides by purpose built L.G.P. machines to the road between Cashel Dhu and Eriboll which transverses the site and then loaded onto trailer to be transported to Eriboll. The transport of heavy loads or machinery may result in further deterioration of the roadway surface.

The size and form of the commercial blocks will be such that felling operations should not adversely affect the visual appearance of the woodland scheme from a long view, although from near view felling sites may initially have an obtrusive appearance.

Clear cuts when properly executed may serve to enhance the ecological diversity of the woodland by providing additional open areas initially, structural diversity and controlled succession in the medium to long term as trees of the second rotation begin to develop and mature.

Soil erosion and compaction with associated problems to watercourses may arise when L.G.P. machines continually use the same tracks or when operations proceed during adverse weather conditions, these effects have been discussed in previous sections.

Some disturbance of flora and fauna can be expected to result from the extraction operation and hence careful planning is required to ensure that such undertakings are only practised at appropriate times of the year.

### **3.7.2 Flora and Fauna.**

As the woodlands mature suitable habitats will develop and be beneficial to a range of woodland fauna and flora species. Birds such as the willow and wood warbler, spotted flycatcher and redstart will establish themselves and flourish, profiting from increased invertebrate numbers and diversity. Black grouse and rare species such as redwing may also establish. The Native pine may serve in the long-term, to provide a suitable habitat which allows the expansion of species currently restricted to the eastern Highland Caledonian pinewoods. "Indeed there may be considerable benefit to eagles with an increase in the diversity and amount of natural prey resulting from the restoration of native flora. We recommend that the conifer element of this scheme consists of native pine, which in the long-term could even provide some suitable nest trees for the eagles"<sup>23</sup>. Mammals such as pine martin, wildcat and fox may also benefit from the woodland cover, as will deer populations.

Open-ground plant species although to a large extent replaced by those of woodlands will survive in open spaces and margins such as buffer strips, deer lawns and rides, providing a useful habitats for invertebrates.

#### 3.7.4 Air.

The growth of trees is often associated with the fixation of CO<sub>2</sub> and scouring of other pollutants proportional to yield class. Recent research however indicates that rate of C-fixation is far greater from existing mire vegetation than trees.

The formation of mature forest with undoubtedly result in a modification of the local micro-climatic conditions within the woodlands themselves, the habitat environment being characterised by increased humidity, reduced temperature fluctuations, wind exposure and direct insolation.

## 3.7.3

<b>Impact Matrix - Mature Forest / Canopy Stage.</b>					<b>+ / -</b>
<b>Likely and Major Impacts.</b>	<b>E</b> <b>x</b> <b>t</b> <b>r</b> <b>a</b> <b>c</b> <b>t</b> <b>i</b> <b>o</b> <b>n</b>		<b>C</b> <b>o</b> <b>n</b> <b>i</b> <b>f</b> <b>e</b> <b>r</b>	<b>B</b> <b>r</b> <b>o</b> <b>a</b> <b>d</b> <b>l</b> <b>e</b> <b>a</b> <b>f</b>	<b>N</b> <b>E</b> <b>T</b>  <b>I</b> <b>M</b> <b>P</b> <b>A</b> <b>C</b> <b>T</b>
Likelihood of Impact └─── 2/5 └─── Severity					
<b>Water</b>	<b>5/1</b>		<b>5/3</b>	<b>5/3</b>	<b>+ / -</b>
Sediment	4/1				-
Turbidity	3/1				-
Ph			5/3	5/3	+ / -
Phosphorous					
Hydrology	5/1		5/3	5/1	-
<b>Soil</b>	<b>5/2</b>		<b>4/4</b>	<b>5/4</b>	<b>+</b>
Compaction	5/2		5/2	5/4	+
pH			3/4	4/3	+ / -
Structure			3/4	5/4	+
Erosion	5/2				-
<b>Air</b>	<b>3/2</b>				<b>-</b>
Particulates	3/2				-
<b>Human</b>	<b>5/3</b>		<b>5/3</b>	<b>5/4</b>	<b>+ / -</b>
Economic	5/3				+
Visual Impact	5/4		5/2	5/5	+ / -
distant	5/3		5/2	5/3	+ / -
close	5/4		5/3	5/4	+ / -
Access Rec.	3/2				-
Material Assets	2/4				-
<b>Flora</b>	<b>5/4</b>		<b>5/4</b>	<b>5/4</b>	<b>+ / -</b>
Wetland	3/3		3/3	3/2	-
Woodland	5/4		5/3	5/4	+
Openland	5/4		5/4	5/4	-
<b>Fauna</b>	<b>4/2</b>		<b>5/3</b>	<b>5/4</b>	<b>+</b>
Woodland mammals	5/2		5/2	5/3	+
Shoreline mammals	3/2				+ / -
Openland mammanls	3/1		5/4	5/3	-
Woodland birds	5/3		5/3	5/4	+
Shoreline birds	3/2				+ / -
Openland birds	3/1		5/4	5/5	+ / -
Amphibians	2/3		5/4	4/2	-
Insects	2/1		5/2	5/1	+

### **3.7.5 Mitigating measures.**

The haul-out of commercial timber will result in soil compaction and erosion with associated affects to watercourses, fauna and flora. Care should therefore be taken to ensure that L.G.P. machines when utilised should stay on firm ground wherever possible and use alternating routes.

If timber is to be extracted from inaccessible and sensitive areas, traditional methods involving selective felling and removal should be considered. They are becoming an increasingly popular (i.e. horse) and economically viable option. Such methods may provide an additional tourist attraction whilst dramatically reducing the impacts of extraction on soil structure, hydrology and flora. Fauna disturbance as a result of noise is also mitigated.

Transport of heavy loads or machinery along the roadway between Eriboll estate and Cashel Dhu may result in the further deterioration of the surfacing which could represent a safety hazard to pedestrians. It is therefore advised that during such manoeuvres hazard signs be erected to warn of impending danger and that the roadway surfacing be reinstated when damaged or in need of repair as a result of such operations.

### **3.8.0 Employment/Economic benefits to the region.**

3.8.1 No attempt has been made to justify the establishment of the Loch Hope scheme on the basis of local employment or revenue creation. Regionally some demand for materials and services will be created but otherwise it would be inappropriate and misleading to assume that the scheme would have any significant impact to local communities apart from knock-on effects associated with mid to long-term conservation, landscaping, amenity and tourism improvements.

### 3.9.0 Landscape design/ Appraisal.

3.9.1 It is accepted that the trees themselves will represent the greatest long-term visual intrusion, the nature and degree of visual impact is however influenced by a number of factors such as distance, lighting conditions and atmospheric clarity which are restrictive in the Hope area as a result of the climate. Matters are also complicated by long daylight hours in summer and short daylight hours in winter, the annual spread of mist, light rain, snow, sleet and fog with low visibility .

The nature of the woodland layout is appropriate and should in fact enhance the scenic variety and value of the area, which for a greater part is devoid of tree cover. From a conservation viewpoint, native conifers would be altogether more appropriate for the commercial blocks than the non-indigenous species envisaged, oak is considered outside of its natural growing range and should be omitted.

The overall scale of the proposal is considered suitable as it allows for extensive areas of unplanted open ground within the site the woodlands to be broken up in association with rocky outcrops, crags and areas of geomorphological interest. This should improve rather than detract from the visual attraction of the area. Watercourses situated throughout the site offer opportunity for the further severing of woodland cover and will also serve as natural fire breaks.

Unplanted margins along the shoreline of Loch Hope should be laid out to incorporate areas of archaeological and ecological interest thereby enhancing the shape of the loch and woodland edge.

The southern boundary of the woodland scheme area south of Allt Loch na Creige Riabhaich is angular and appears rather artificial. This should be adjusted to provide a more natural contour related appearance by extending the fence line south beyond Allt an Locha Chrocaich and feathering of the treeline along the upper slopes of the river Strathmore.

At Allt Ach nan Gambna, which represents the northern boundary of the scheme, appearance should be improved. This could be achieved by creating an enclosure, tapered down towards Arnaboll between the upper track and the loch-side, in order to promote an area of natural regeneration.



### **3.10.0 Further Discussions.**

#### **3.10.1 Seed Source.**

The S.N.H. have expressed concern with regard to preserving the genetic integrity of ecologically important sites within or adjacent to the proposed woodland scheme site. The following considerations are to be taken into account;

a) During 1991 two small blocks were fenced off (see 4.9.0) and planted with gean, rowan, oak, sycamore and birch of unknown provenance. Once mature these trees (i.e. birch) may hybridise with locally native species, gradually diminishing their genetic integrity. It may on the other hand be argued that lacking genetic finger printing evidence, it is ill advised to assume that genetic integrity of presumably 'ancient' woodland remnants is still/was ever intact, or will remain so in the future. Bearing in mind that birch itself is a pioneer and transitional species, characterised by light seed which may be transported by winds over great distances, this seems very unlikely.

b) With regard to point a, conflicts of interest may arise when one considers the establishment through planting of native woodland schemes and the provenance of the seed source for planting stock. While the one side may argue that genetic purity of the local stock is of importance, the other may regard the logistics and practical feasibility of establishment as a priority. A quantity of seed from Reay Forest 12 miles S.W. of Loch Hope may be deemed appropriate and is presently available for propagation.

#### **3.10.2 Recommendations.**

With regard to native broadleaves, an immediate local and appropriate seed source is available and should be utilised. Existing fencelines and saplings of unknown provenance should be removed from the fore-mentioned blocks.

Woodlands establishment over a period of two consecutive years, could be considered. For example in year one; fencing and conifer block ground preparation/planting operations could be conducted. In year two; ground preparation; planting of mixed blocks and broadleaves concluded. Potentially

damaging impacts would be less extreme and sufficient time available for seed from immediate local resources to be collected and propagated for planting stock.

### 3.11.0 **Qualifying Statements.**

3.11.1 The eco-resource baseline study represents a useful database for future monitoring of the woodlands scheme. Some inadequacies are apparent and can be associated with survey time, seasonal and resources constraints. These are studies related to the composition and distribution of bird, fish, freshwater and terrestrial invertebrate populations.

Studies and data relating to the botanical interest of the study area are as comprehensive as was feasible, considering the constraints encountered, and may be suitable as a basis for further study. Updating and enhancement could be conducted on a mid- to long-term timescale and involve research institutes, colleges, schools and interested parties from the area. Prior to the initiation of the woodland scheme, permanent transects and/or quadrats could be established to facilitate the control and monitoring of any resultant ecological change. Once completed small scale monitoring could be undertaken on a 5-10 year basis.

Predictions as to the long term effect of the scheme are difficult to ascertain in view of the limited knowledge available with regards to any equivalent schemes within the area. Ironically the process of study and monitoring will determine any change in environmental or ecological conditions. However once the effects have been realised there is little that can be undertaken to divert or compensate for them.

Generally, it may be concluded, that the overall scale, layout and composition and design is appropriate and should with management, serve to enhance both wildlife, landscape and human interests. The development will be especially beneficial to woodland mammals, birds and invertebrates as it redresses the distorted relationship between open ground and woodlands within the area. Alternatively however afforestation represents a major and profound modification to open ground species composition, habitats and ecosystems. Presently existing habitats, ecosystems and species relationships will be replaced by those of woodlands. Changes to the 'landscape' or the visual perceptions thereof will also occur as a result of the scheme. 'Change' however can be viewed as an inherent

and integral element of natural dynamics, whether it is perceived as positive or not is open to subjectivity.

## **SECTION 4 : Appendices.**

- 4.1.0 Preliminary Planting Proposal.
- 4.2.0 Present Planting Proposal Map.
- 4.3.0 M.L.U.R.I. Soil Map.
- 4.4.0 Transect/Soil Survey Locations Map.
- 4.5.0 Soil Survey Data.
- 4.6.0 Soil Map.
- 4.7.0 M.L.U.R.I. Land-use Map.
- 4.8.0 Species List - Flora.
- 4.8.1 Species List - Fauna.
- 4.9.0 Vegetation Survey Map.
- 4.10.0 Landscape Appraisal.
- 4.11.0 Areas of Material & Ecological Interest Map.
- 4.12.0 N.V.C. Classification of Plant Communities.
- 4.13.0 References.
- 4.14.0 Bibliography.
- 4.15.0 Acknowledgements.

The aim of the project is to establish a mixed woodland on the site in an effort to enhance the areas environmental value whilst also creating a future timber asset.

### **FENCING**

The area will require fencing against stock and red deer. It is proposed to erect a deer fence along the top (west) boundary, then down into the loch at the north and south ends. The fences will protrude into the loch at these points, thereafter rails will be erected into a large Y shape into 4/5 ft depth of water, therefore if deer swim round the first part of the Y they are given the impression of being trapped and swim back out.

### **PLANTING LAYOUT**

The project has/will be laid out in an effort to blend into rather than be placed into the landscape. All the watercourses have been identified and will form a major part of the layout by breaking up the woodland using their natural lines, any other rides required to break up the woodland will be carefully laid out by following natural contours on the ground. Straight lines will be avoided at all times. Watercourses will be protected by leaving a minimum of 20 metres on each side untouched. Where water courses near the loch, these distances will increase to around 40&50 metres and even more whilst encompassing old field sites, ruins, existing natural woodland and any other interesting features. A fairly substantial distance of no less than 40 metres will be kept back from the loch side, again this will increase for existing wooded areas, (which will be encouraged to expand) and any features mentioned previously. The top boundary line has been laid out using the natural features of the land in coming down below outcrops and protruding up into basins, thus creating a smooth flowing line in harmony with the particular area.

### **ROADS**

No roads will be constructed. The existing track from Eriboll will be used for access to the site. Any harvesting envisaged in the future will be very small scale as the woodland will not be a commercial timber venture, therefore timber would be extracted by L.G.P. purpose built machines up to the existing track thereafter by tractor & trailer to Eriboll.

## GROUND PREPARATION

In order to create suitable planting sites for the trees, mounds will be cut using the Mclarty moulder. This machine is trailed behind a L.G.P. tracked tractor, it cuts mounds of approximately 40x40cm by 20/30cm deep out of the ground and leaves them inverted. This machine does not cause any drainage channels or furrows, therefore silting and run off will not occur and ground disturbance is minimal. This type of ground preparation does not have the harsh and obtrusive nature of ploughed furrows and associated problems and is altogether more environmentally acceptable.

## PLANTING

The main species will be native broadleaves, made up as follows:

- Birch (pubescens)	25%
(pendula)	10%
- Alder	25%
- Rowan	10%
- Willow, oak, hazel	10%

The 20% conifer element will be made up of sitka spruce, Scots pine and larch. The birch and alder will be planted in irregular species groups according to the soil types. The pubescens and alder on the poorer wetter soils with pendula on the drier sites along with the rowan. The willow will be scattered throughout on suitable wet sites whilst the oak and hazel will be kept to the most fertile sites. The conifers will also be planted in species groups and will be planted in drifts mainly on areas well away from important spawning burns. The stocking rate is envisaged to be @ 1,800 broadleaves per ha<sup>-1</sup> and 2,300 conifers. The existing areas of natural regeneration will be encouraged by leaving a radius of approximately 200 metres unplanted to allow regeneration.

## FERTILISING

In order to give the trees an initial boost, phosphate will be hand applied to each tree at a rate of 200 kg ha<sup>-1</sup>. Particular care will be taken whilst distributing to ensure that no bags are left near burns or other wetlands.

## **DRAINAGE**

The site gently rises from approximately 10 metres A.S.L. to about 250 metres A.S.L. The majority of which is fairly free draining, therefore no drainage will be required.

## **WEEDING**

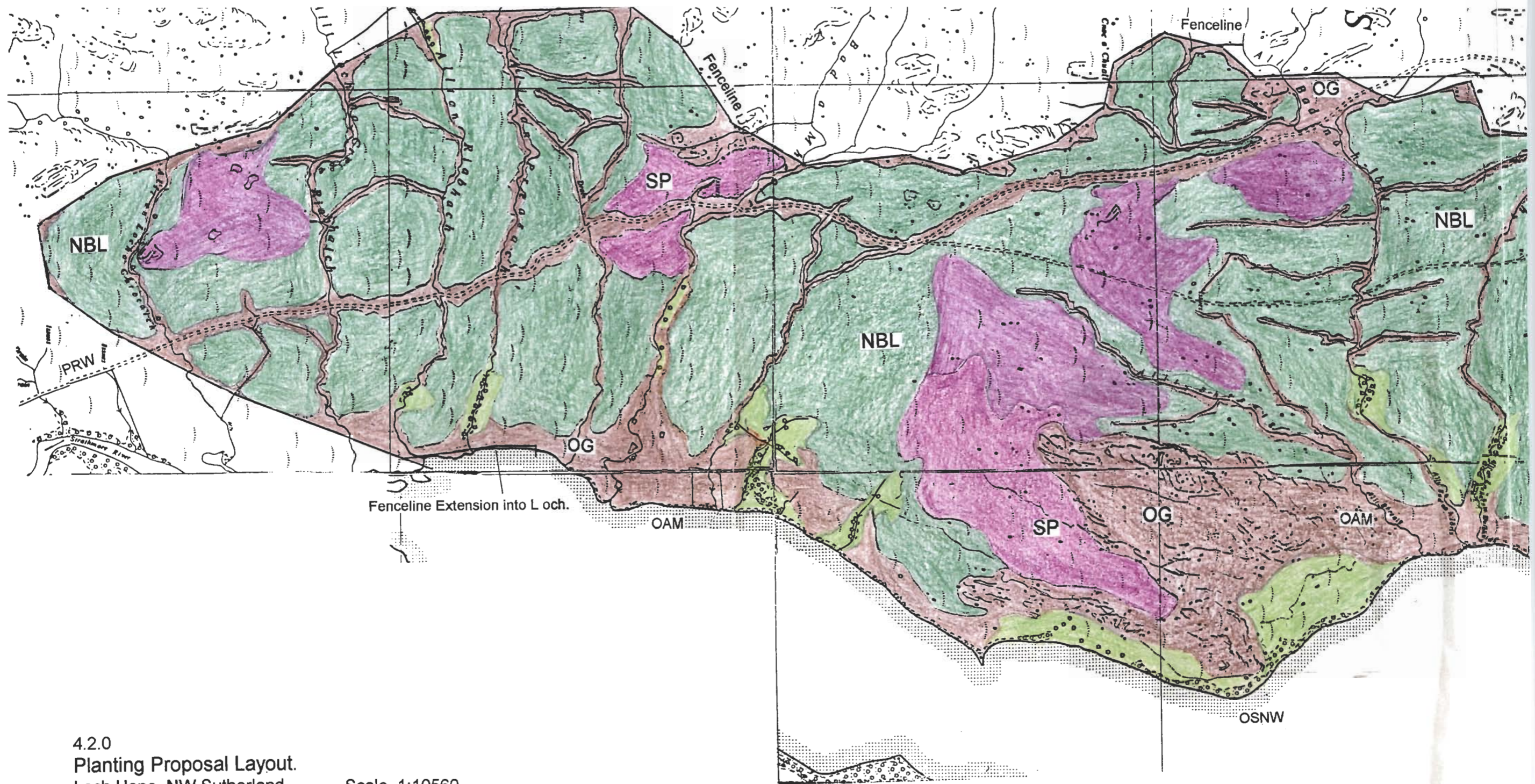
Due to the nature of the soils and vegetation weeding is not envisaged to become a problem, therefore no chemical weeding will be required.

## **PROTECTION (Deer management plan)**

At present there is not a great deal of red deer on the site or in Eriboll estate itself.









In the early stages of establishment, deer which manage to enter the woodland will have to be removed. To this end two deer jumps will be constructed at suitable points at the southern fenceline thus allowing deer the chance of self egress. Any deer which do not use the facility will have to be shot. It is not envisaged that deer will cause a problem.

The layout of the woodland has taken the longer term deer population into consideration. The old field sites etc. which are to be left unplanted will act as deer lawns and indeed valuable open spaces for other flora and fauna. The vast amount of burnsites will also act as deer control areas and the deer will also take advantage of the larger prominent unplanted sites, which has become evident in other woodland sites throughout the Highlands. Apart from Red deer, roe and sika will undoubtedly colonise the woodland as it matures, but with careful management they should become an asset rather than a problem and their population will be controlled to this end.

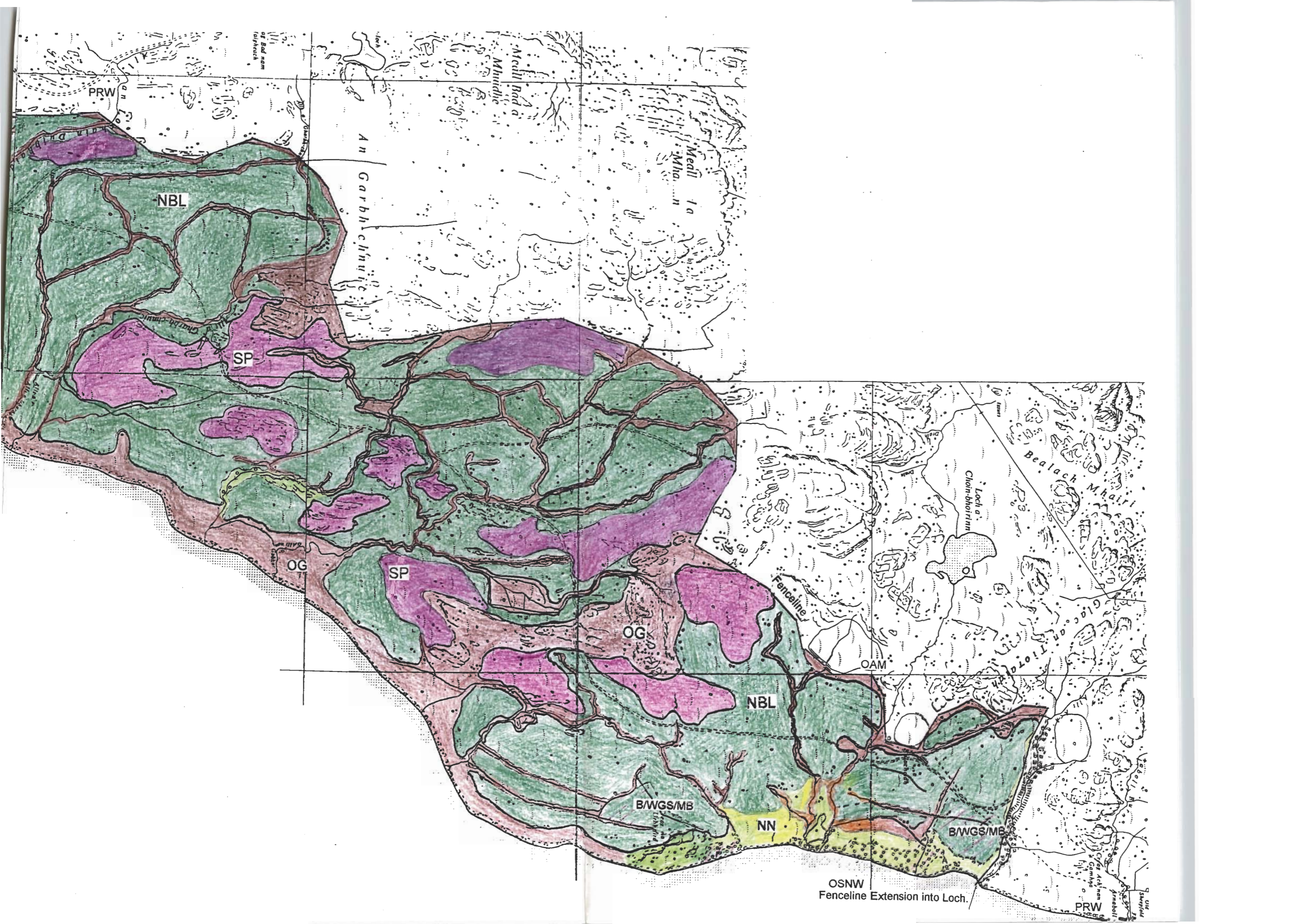


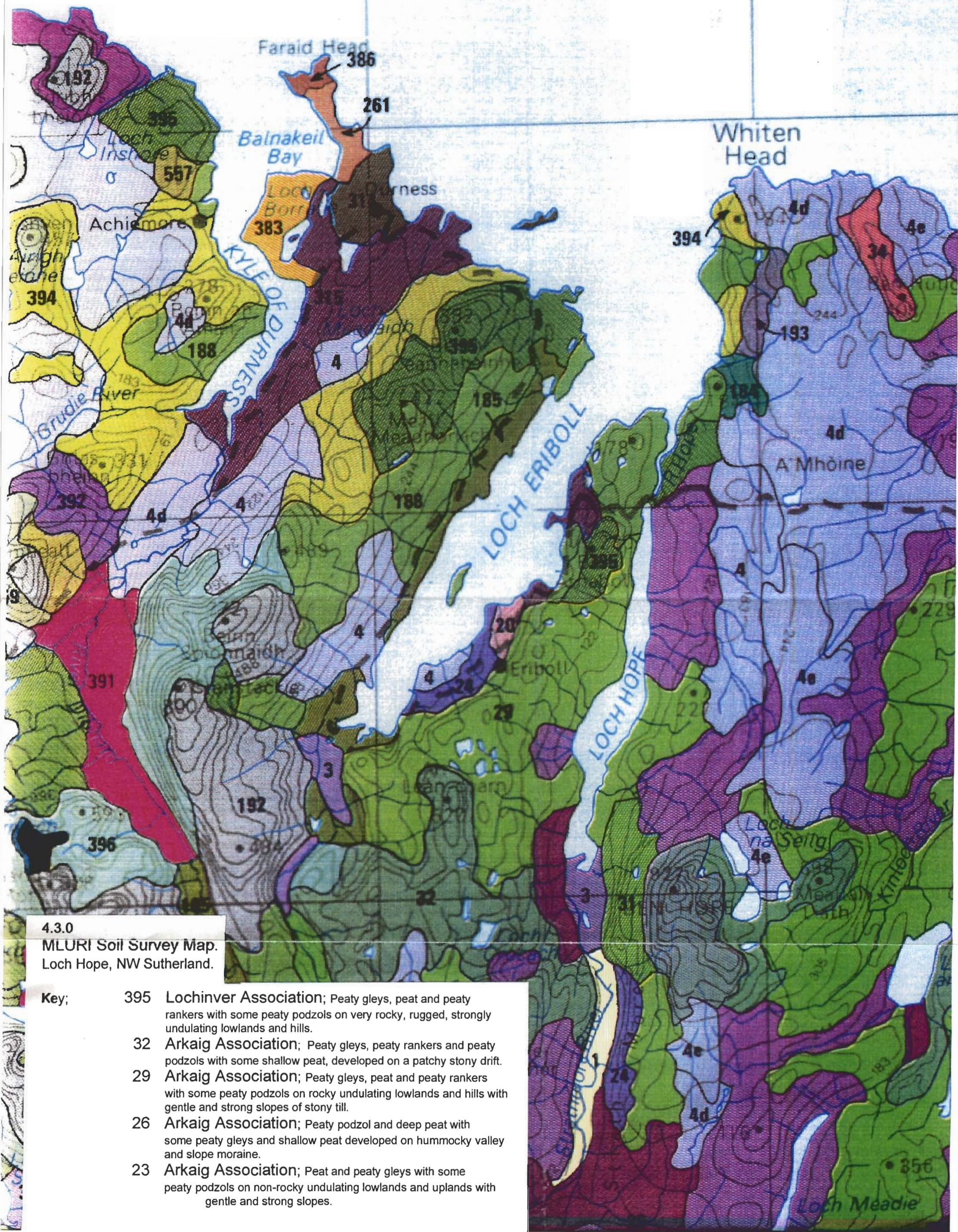
4.2.0  
 Planting Proposal Layout.  
 Loch Hope, NW Sutherland.

Scale 1:10560.

- |          |                                      |   |  |
|----------|--------------------------------------|---|--|
| NN       | Areas of Natural Regeneration.       |    |  |
| OG       | Open Ground.                         |    | Main Service Ride.        |
| SP       | Scots Pine.                          |    |  |
| NBL      | Mixed Native Broadleaf.              |    |  |
| OSNW     | Other Semi-Natural Woodland.         |  |  |
| B/WGS/MB | Previous WGS Block, Mixed Broadleaf. |  |  |
| OAM      | Other Ancient Monument.              |   | PWR Public Right of Way.  |

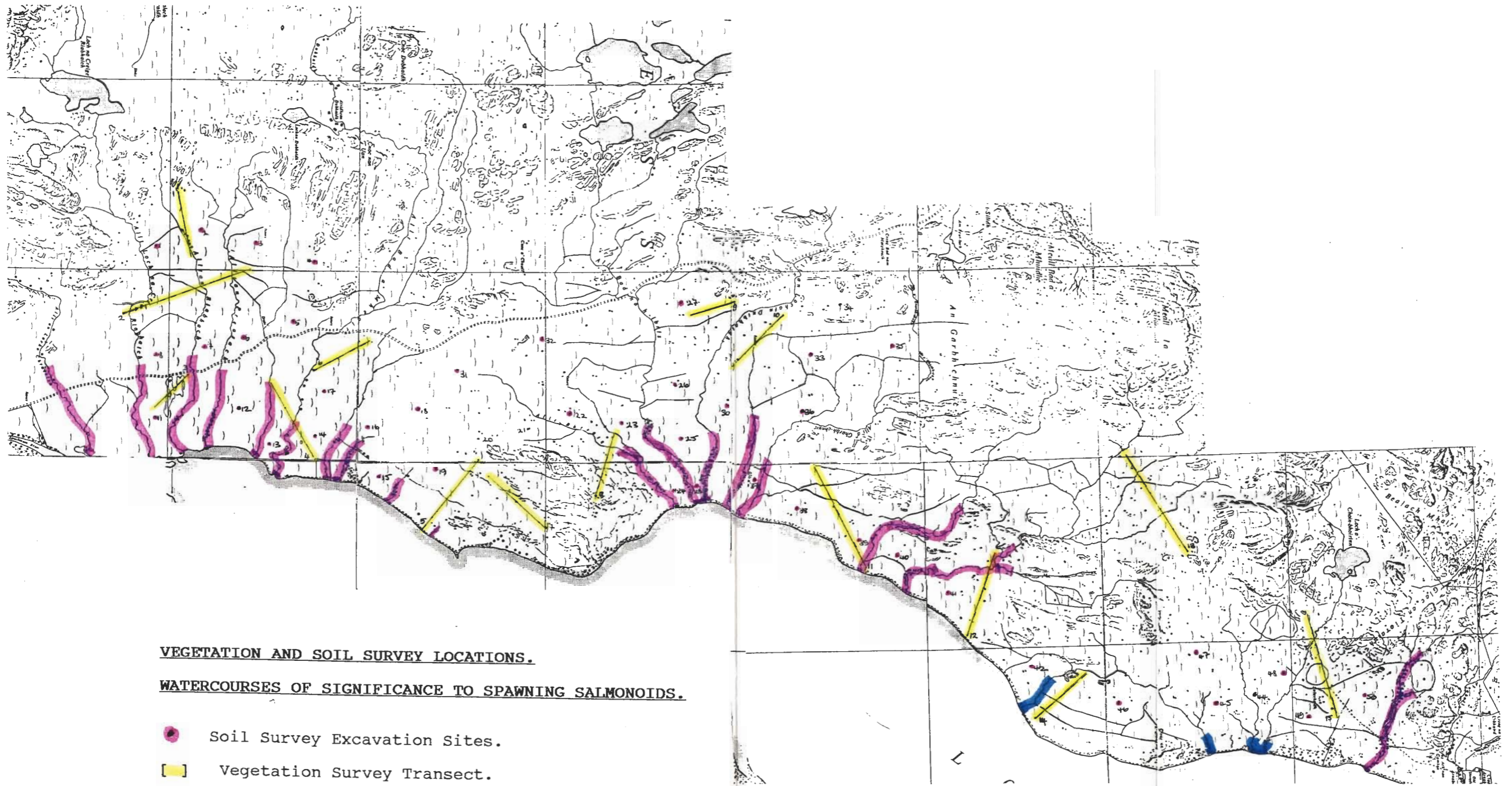






4.3.0  
MLURI Soil Survey Map.  
Loch Hope, NW Sutherland.

- Key;**
- 395 Lochinver Association; Peaty gleys, peat and peaty rankers with some peaty podzols on very rocky, rugged, strongly undulating lowlands and hills.
  - 32 Arkaig Association; Peaty gleys, peaty rankers and peaty podzols with some shallow peat, developed on a patchy stony drift.
  - 29 Arkaig Association; Peaty gleys, peat and peaty rankers with some peaty podzols on rocky undulating lowlands and hills with gentle and strong slopes of stony till.
  - 26 Arkaig Association; Peaty podzol and deep peat with some peaty gleys and shallow peat developed on hummocky valley and slope moraine.
  - 23 Arkaig Association; Peat and peaty gleys with some peaty podzols on non-rocky undulating lowlands and uplands with gentle and strong slopes.



**VEGETATION AND SOIL SURVEY LOCATIONS.**

**WATERCOURSES OF SIGNIFICANCE TO SPAWNING SALMONIDS.**

- Soil Survey Excavation Sites.
- Vegetation Survey Transect.
- Watercourses of Significance.
- Watercourses of Lesser Significance.

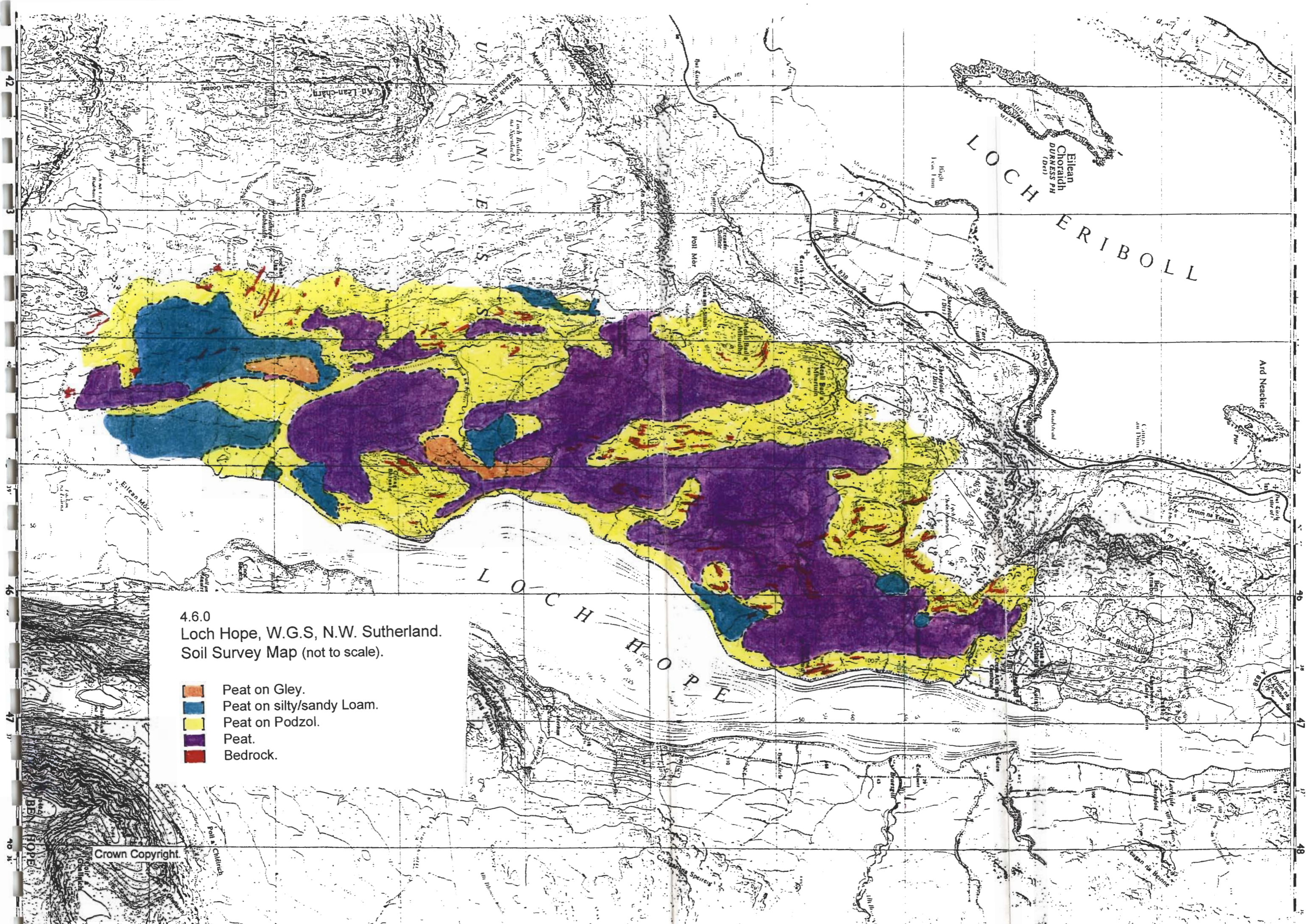
4.4.0  
Loch Hope, W.G.S, N.W. Sutherland.  
Transect/Soil Survey Location Map.

#### 4.5.0 Soil Survey Data.






##### Location

- 1 10 cm peat on silty / sandy loam - gley on ironpan
- 2 ditto
- 3 ditto
- 4 18 cm peat on podzol ironpan
- 5 30 cm peat on gley
- 6 ditto
- 7 20 cm peat on podzol /gleyed
- 8 25 cm peat on gleyed podzol / ironpan
- 9 ditto
- 10 20 cm peat on podzol / ironpan
- 11 30 cm peat on loam gley / very stony
- 12 ditto
- 13 20 cm peat on podzol
- 14 35 cm peat on podzol / very stony
- 15 15 cm peat on podzol / ironpan / very stony
- 16 20 cm peat on podzol / alluvial till
- 17 20 cm peat on podzol
- 18 30 cm peat on parent rock
- 19 Deep peat
- 20 ditto
- 21 25 cm peat on podzol with ironpan
- 22 35 cm peat on gley
- 23 ditto
- 24 20 cm peat on glacial till
- 25 Deep peat
- 26 20 cm peat on podzol
- 27 ditto
- 28 20 cm peat on glacial till
- 29 18 cm peat on gley with ironpan
- 30 32 cm peat on gley
- 31 Deep peat
- 32 25 cm peat on gleyed podzol slight ironpan
- 33 ditto
- 34 20 cm peat on podzol

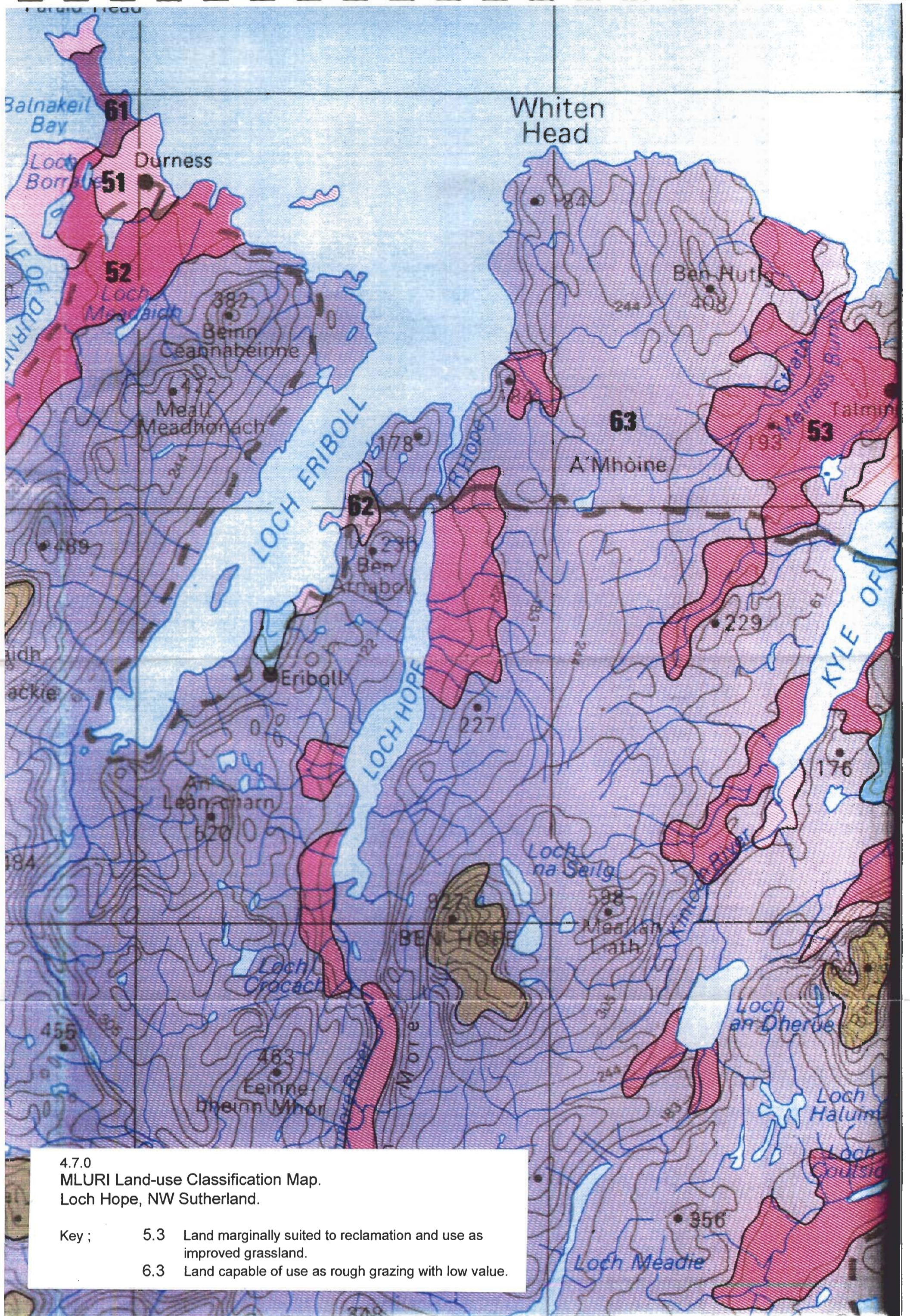
- 35 25 cm peat on bedrock
- 36 Deep peat
- 37 20 cm peat on gleyed ironpan
- 38 25 cm peat on bedrock
- 39 Deep peat on alluvial
- 40 ditto
- 41 ditto
- 42 18 cm peat loam on gleyed till
- 43 20cm peat on podzol
- 44 Deep peat on bedrock
- 45 50cm peat on gley / parent material
- 46 30/50cm peat on bedrock podzol
- 47 20/30cm peat on bedrock
- 48 18 cm peat on podzol / ironpan
- 49 Deep peat on ironpan
- 50 25 cm peat on podzol / ironpan



4.6.0  
Loch Hope, W.G.S, N.W. Sutherland.  
Soil Survey Map (not to scale).

-  Peat on Gley.
-  Peat on silty/sandy Loam.
-  Peat on Podzol.
-  Peat.
-  Bedrock.

Crown Copyright.



4.7.0  
MLURI Land-use Classification Map.  
Loch Hope, NW Sutherland.

- Key ;
- 5.3 Land marginally suited to reclamation and use as improved grassland.
  - 6.3 Land capable of use as rough grazing with low value.

#### 4.8.0 Species List - Flora.

##### Botanical name.

##### Common name.

*Sphagnum* spp.

*Thuidium tamariscinum*

*Pseudoscleropodium purum*

*Breutelia chrysocoma*

*Polytrichum commune*

*Cladonia uncialis*

*C. portentosa*

*Plagothecium nemorale*

*Racomitrium lanuginosum*

*Diacranum* spp.

*Rhytidiadelphus triquertus*

*Pleurozia purpurea*

*Selaginella selaginoides*

Lesser Clubmoss

*Leucobryum glaucum*

*Scorpidium scorpoides*

*Peltigera canina*

Dog Lichen

*Erica cinerea*

Bell Heather

*E. tetralix*

Cross-leaved Heath

*Calluna vulgaris*

Heather

*Myrica gale*

Bog Myrtle

*Vacc. vitis-idaea*

Cowberry

*Arctostaphylus uxo urvi*

Bearberry

*Molinea caerulea*

Purple Moor-grass

*Trichophorum cespitosum*

Deer-grass

*Eriophorum vaginatum*

Hair's-tail Cotton-grass

*E. angustifolia*

Common Cotton-grass

*E. latifolium*

Broad-leaved Cotton-grass

*Anthoxanthum odoratum*

Sweet Vernal-grass

*Holcus lanatus*

Yorkshire Fog

*Festuca rubra*

Red Fescue



<i>F. ovina</i>	Sheep's Fescue
<i>F. vivipara</i>	Viviparous Fescue
<i>Danthenia procumbens</i>	
<i>Nardus stricta</i>	Mat-grass
<i>Agrostis canina</i>	Velvet bent
<i>A. vinealis</i>	
<i>Carex pallescens</i>	Pale Sedge
<i>C. demissa</i>	Common Yellow Sedge
<i>C. dioice</i>	
<i>C. rostrata</i>	Bottle Sedge
<i>C. echinata</i>	Star Sedge
<i>C. panicea</i>	Carnation Sedge
<i>C. pulicaris</i>	Flea Sedge
<i>C. nigra</i>	Common Sedge
<i>C. pilulifera</i>	
<i>Schoenus nigricans</i>	Bog-rush
<i>Helictotrichon pubescens</i>	Hairy Oat-grass
<i>Deschampsia flexuosa</i>	Wavy Hair-grass
<i>Eliocharis uniglumis</i>	One-glumed Spike-rush
<i>E. cinqueflora</i>	Few-flowered Spike-rush
<i>E. palustris</i>	Common Spike-rush
<i>Juncus squarrosus</i>	Heath Rush
<i>J. kochii</i>	
<i>J. effusus</i>	Soft Rush
<i>Isolepis setacea</i>	Bristle Scirpus
<i>Narthecium ossifragum</i>	Bog asphodel
<i>Potentilla erecta</i>	Tormentil
<i>Polygala serpyllifolia</i>	Heath Milkwort
<i>Pedicularis sylvatica</i>	Lousewort
<i>Trifolia</i> spp.	
<i>Oxalis acetosella</i>	Wood-sorrel
<i>Prunella vulgaris</i>	Selfheal
<i>Plantago lanceolata</i>	Ribwort Plantain
<i>Viola</i> spp.	Violet
<i>Achillea millefolium</i>	Yarrow

<i>Euphrasia</i> spp.	Eye bright
<i>Hydrocotyle vulgaris</i>	Marsh Pennywort
<i>Saxifraga aizoides</i>	Yellow M. Saxifrage
<i>Chrysoplenium oppositifolium</i>	Opp.-lvd Golden Saxifrage
<i>Ranunculus flammula</i>	Lesser Spearwort
<i>R. lingua</i>	Greater Spearwort
<i>Dactylorhiza fuchsii</i>	Common Spotted Orchid
<i>D. maculata</i>	Heath Spotted Orchid
<i>Platanthera bifolia</i>	Lesser Butterfly Orchid
<i>Hypercheoris glabra</i>	Smooth Cat's-ear
<i>H. radicata</i>	Common Cat's-ear
<i>Hypericum perforatum</i>	Perforate St Johns Wort
<i>Leontodon autumnalis</i>	Autumn Hawkbit
<i>Galium</i> spp.	Bedstraw species
<i>Galium mollugo</i>	Hedge Bedstraw
<i>Equisetum arvense</i>	Field Horsetail
<i>Melampyrum pratense</i>	Common Cow-wheat
<i>Drosera anglica</i>	Great Sundew
<i>D. rotundifolia</i>	Round-leaved Sundew
<i>D. intermedia</i>	Oblong-leaved Sundew
<i>Pinguicula vulgaris</i>	Common Butterwort
<i>Potamogeton polygonifolius</i>	Bog Pondweed
<i>Cirsium palustre</i>	Marsh Thistle
<i>Linum catharticum</i>	Fairy Flax
<i>Conopodium majus</i>	Pignut
<i>Thymus drucei</i>	Wild Thyme
<i>Betula</i> spp.	Birch
<i>Salix</i> spp.	Willow
<i>Ilex aquifolium</i>	Holly
<i>Dryopteris</i> spp.	Fern
<i>Pteridium aquilinum</i>	Bracken
<i>Oriopteris limbosperma</i>	Mountain Fern
<i>Blechnum spicant</i>	Hard Fern

## 4.8.1 Species List - Fauna.

### Mammals

- Rabbit
- Red deer
- Roe deer
- Field vole
- *Oryctolagus cuniculus*
- *Cervus elaphus*
- *Capreolus capreolus*
- *Microtus agrestis*

### Birds

- Red Grouse
- Peregrine Falcon
- Meadow Pipit
- Carrion crow
- Merlin
- Golden plover
- Black-throated diver
- Common Sandpiper
- Golden eagle
- Nightjar (poss.sighting)
- *Lagopus lagopus*
- *Falco peregrinus*
- *Anthus pratensis*
- *Corvus corone*
- *Falco columbarius*
- *Pluvialis apricaria*
- *Gavia artica*
- *Actitis hypoleucos*
- *Aquila chrysaetos*
- *Caprimulgus europaeus*

### Amphibians

- Common Frog
- Common Toad
- Common Lizard
- *Rana temporaria*
- *Bufo bufo*
- *Lacerta vivipara*

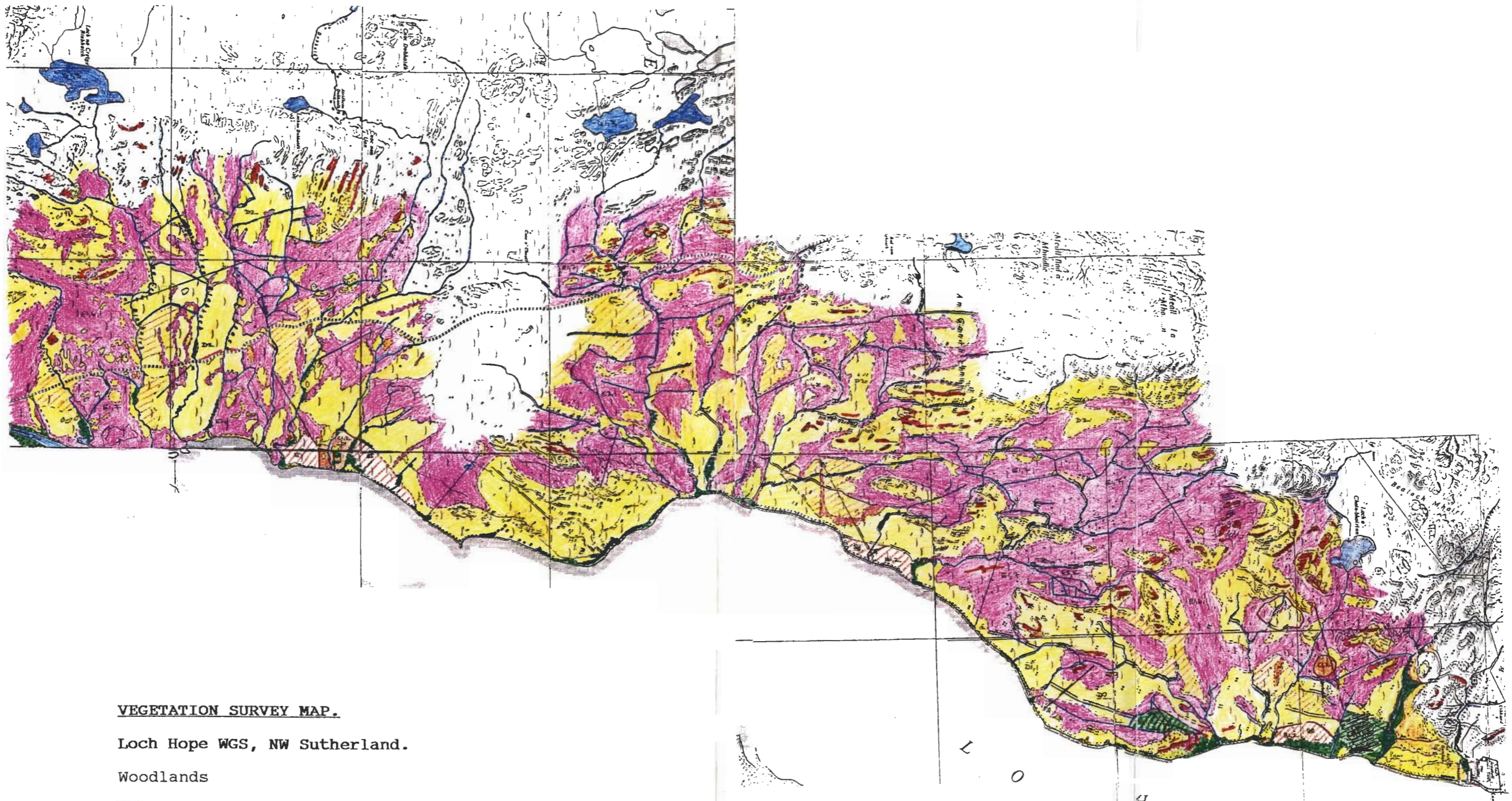
### Fish

- Brown Trout
- Common eel
- *Salmo trutta*
- *Anguilla anguilla*

## Invertebrates

- Golden ringed Dragonfly
- Froghopper
- Grasshopper
- Caddis fly
- Midge
- Horse-fly
- Hunting spider
- Crane-fly
- Red-ant











- *Cordulegaster boltonii*
- *Lepyronia coleoptrata*
- Fam. Acrididae
- Fam. Limnephilidae
- Fam. Culicidae
- Fam. Tabanidae
- Fam. Tomisidae
- Fam. Tipulidae
- Fam. Formicidae



VEGETATION SURVEY MAP.

Loch Hope WGS, NW Sutherland.

Woodlands

	Broadleaf Semi-natural		Broadleaf Plantation
	Acid Grassland Semi-Improved		Mire
	Acid Dwarf Scrub Heath		Heath/Mire Mosaic
	Bracken		Bedrock exposure
	Standing Water		Running Water

49.0

Loch Hope, W.G.S, N.W. Sutherland.  
Proposed Site, Vegetation Survey Map.



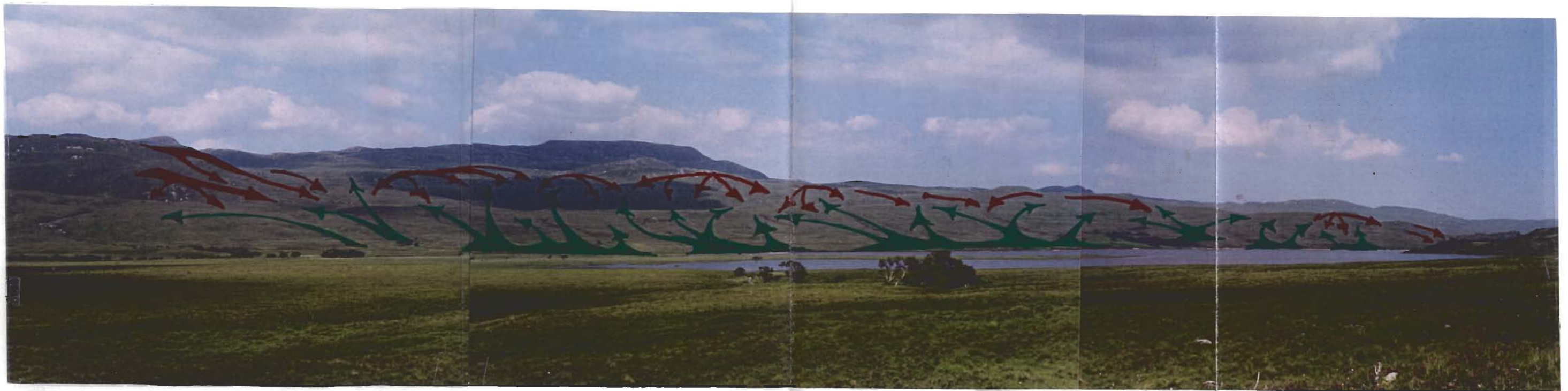
4.10.0  
Loch Hope, W.G.S, N.W. Sutherland.  
Location of Landscape Appraisal Viewpoints.



Present Landscape as seen from Viewpoint A.

4.10.1  
Loch Hope, W.G.S, N.W. Sutherland.  
Analysis of Visual Forces.

- [↗] Visual forces pulling woodland shapes up concave slopes or valleys.
- [↘] Visual forces pushing woodland shape down convex slopes or spurs.



Present Landscape as seen from Viewpoint C.



4.10.2  
Loch Hope, W.G.S, N.W. Sutherland.  
Present Landscape as seen from Viewpoint A.  
Northern End of Scheme.

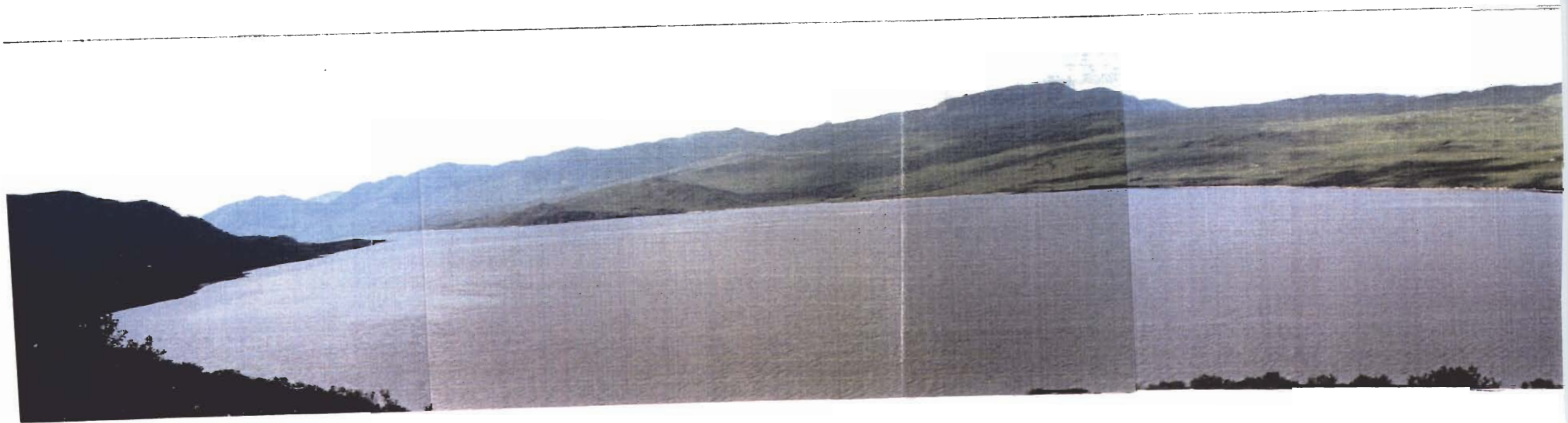


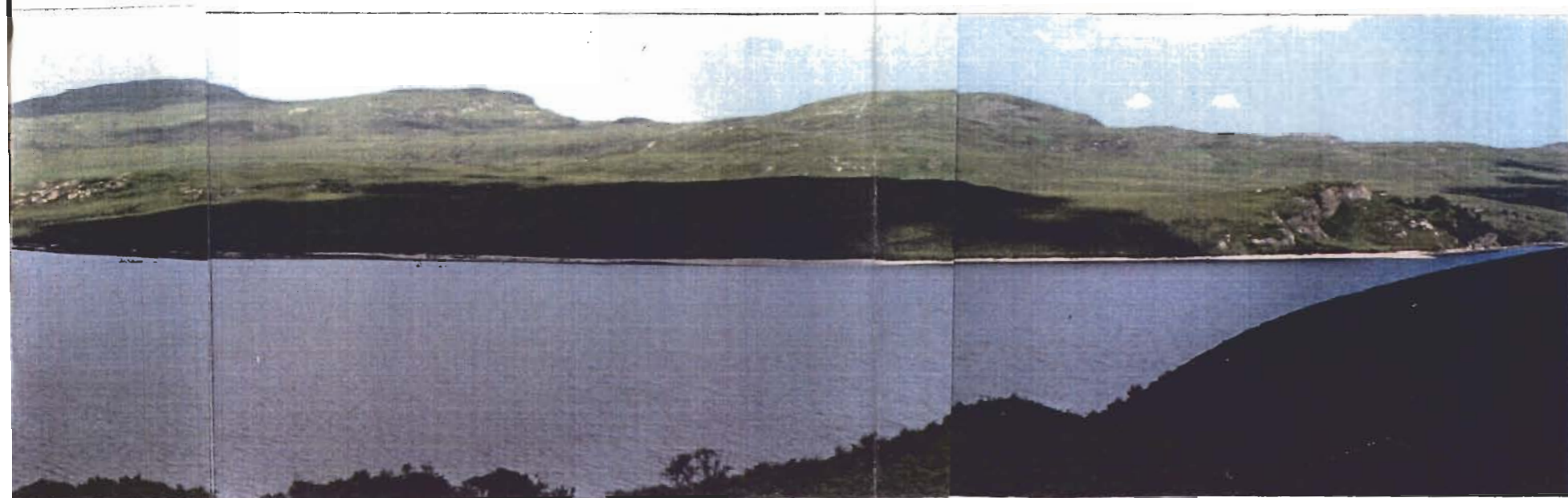
Tree-line protruding up into basins and valleys.

Planting held back from archaeological sites.



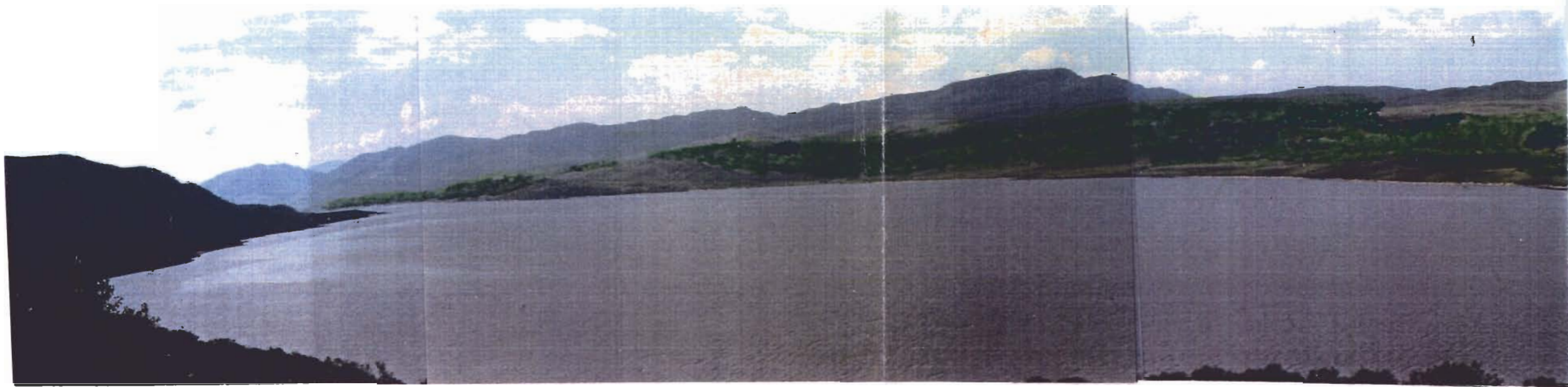
4.10.3  
Loch Hope, W.G.S, N.W. Sutherland.  
Landscape Projection from Viewpoint A, showing the  
Northern End of Scheme, 40 yrs after Planting.





Tree-line protruding up into basins and valleys.

Planting



Varied and substantial loch-side margin.

Top boundary line using natural attributes of landscape.

held back below rocky-outcrops.





4.10.6  
Loch Hope, W.G.S, N.W. Sutherland.  
Present Landscape as seen from Viewpoint  
Southern End of Scheme.

Tree-line held back below rocky-outcrops.

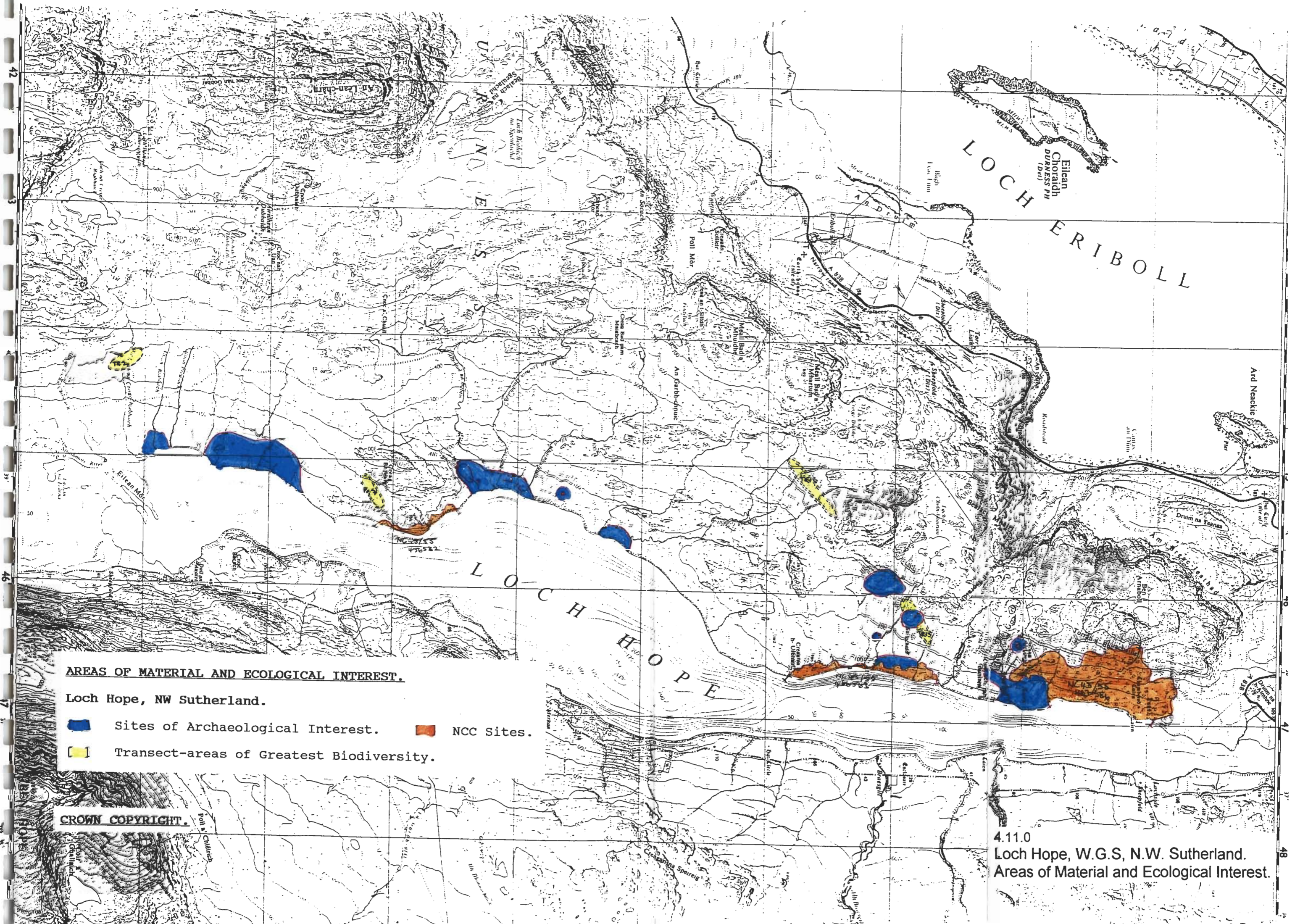
Planting held back from archaeological sites.

Tree-line protruding up into basins and valleys.



Varied and substantial loch-side margin.

4.10.7  
Loch Hope, W.G.S, N.W. Sutherland.  
Landscape Projection from Viewpoint C, showing  
the Southern End of Scheme, 40 yrs. after Planting.



**AREAS OF MATERIAL AND ECOLOGICAL INTEREST.**

Loch Hope, NW Sutherland.

- Sites of Archaeological Interest.
- NCC Sites.
- Transect-areas of Greatest Biodiversity.

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4.11.0  
Loch Hope, W.G.S, N.W. Sutherland.  
Areas of Material and Ecological Interest.



#### 4.12.0 Loch Hope, NW Sutherland.

**N.V.C. Classification** of transect data "Match" software.

Transect No.	Plant Community	Correlation
1	M16b	40.9
2	M15c	46.8
	M15b	42.6
3	M15c	43.2
	M15b	40.0
	M17b	39.5
4	M15c	35.8
	M16a	34.4
	M17a	33.5
5	M15c	42.2
	M25a	36.9
6	M15c	41.4
	M21b	40.6
7	M17	42.6
	M15	40.0
	M21	39.7
8	M15c	43.9
	M15b	43.2
	M17a	40.9
9	M17a	45.8
	M17b	45.2
	M15c	44.3
10	M15a	41.8

Transect No.	Plant Community	Correlation
11	M16b	39.5
	M17a	37.2
	M15c	37.1
12	M25a	41.9
	M17a	45.3
	M15c	43.7
13	M15c	50.5
	M17a	50.0
14	M17a	45.8
	M17b	42.9
15	M15c	48.0
	M15b	43.7
	M15	43.0

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