Derelict and Reclaimed Land

1. Introduction

Derelict and reclaimed land can be particularly hostile for tree growth and often present important challenges to successful woodland establishment. However there is now considerable information and experience as to the practical techniques necessary to establish successful woodland on such sites.

The purpose of this instruction is to highlight the main factors that Conservancies and agents should consider when dealing with WGS on derelict and reclaimed sites. Publications that give further information and advice are listed under Section 5 'Sources of Advice'.

WGS applications that compromise the standards laid down within Bulletin 110, 'Reclaiming Disturbed Land for Forestry' should not be approved by Conservancies.

A number of key components should be considered in all WGS applications covering derelict and reclaimed land (see Section 5 below).

2. Extent of Derelict Land

The Scottish Office compiles results from an annual survey on Vacant and Derelict Land in Scotland. The main points from the 1997 survey are:

- There are 12,756 hectares of vacant and derelict land in Scotland of which 4,627 hectares are classed as vacant and 7,899 hectares as derelict.
- Glasgow and North Lanarkshire together contain 32% of vacant and derelict land (Chart 1 shows the 6 Local Authorities with most vacant and derelict land).
- 46% of derelict land had been previously been used for mineral extraction.
- The most common use of vacant land is for residential purposes (30%) whilst the most common use of treated derelict land is for agriculture (26%).
- As an end use forestry/woodland account for only 3% (221hectares) of treated derelict land and 1% (40hectares) of vacant land.

Chart 1 - 6 Local Authorities with most Vacant & Derelict land

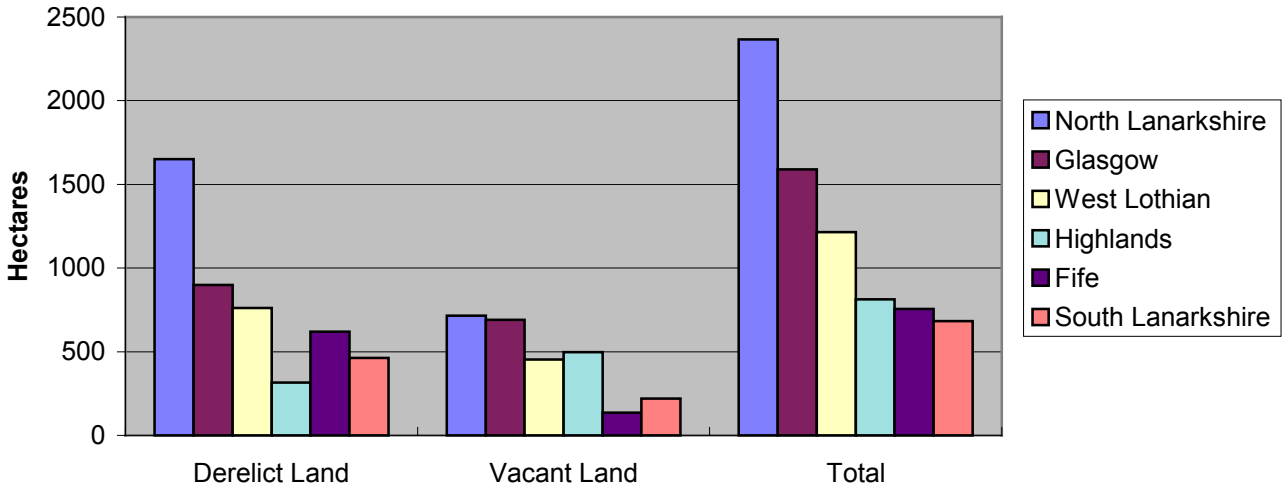
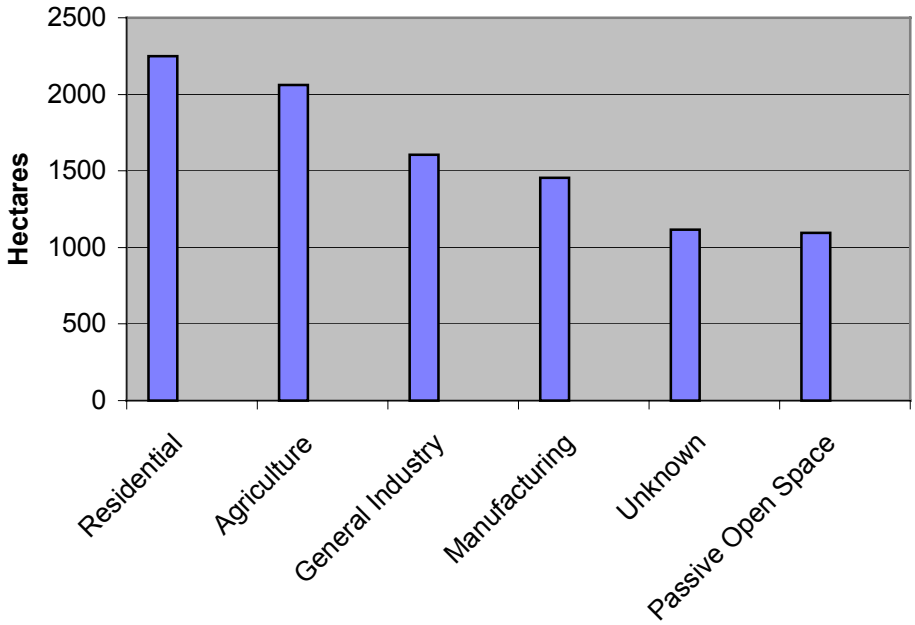


Chart 2 - 6 Most Common End Uses for Vacant/Treated Derelict Land



Although there are currently no official statistics for operational land (i.e. land subject to active mineral working) and it's intended afteruse it is estimated that within the Central Scotland Forest (CSF) Area there are 200 hectares of opencast land worked each year. Total areas of woodland planted within CSF and the proportion planted on treated derelict and mineral sites are as follows:

Central Scotland Forest

Year	1995/96	1996/97	1997/98	1998/99	1999/00
Total planted ha	622	454	439	924	813
Ha of mineral/ landfill sites restored	16	22	48	24	74
Ha of derelict land restored to woodland	21	59	177	86*	54

*This is considered to underestimate as complete information was not provided by Local Enterprise Companies

3. Consultation Procedures

Within the ***Town and Country Planning (Scotland) Act 1997*** there is a statutory duty for planning authorities to consult the Forestry Commission before imposing an aftercare condition for land being reclaimed to forestry.

Achieving good standards of woodland establishment during the aftercare period is very dependent on site restoration being carried out satisfactorily. Although there is no statutory duty for local authorities to consult the Forestry Commission regarding restoration, it is highly desirable for Forestry Commission staff to be involved, preferably at an early stage of the process.

It is therefore recommended that Forestry Commission staff work closely with Local Authority staff.

The planning authorities require to consult the Forestry Commission in the following circumstances:

- if specifying forestry as an afteruse, to establish whether it is appropriate to specify that use.

- if forestry is an acceptable use, to establish whether steps to be taken should be included in an aftercare scheme or in an aftercare condition

- the steps to be specified in an aftercare condition which specifies a use for forestry or agriculture.

- before approving an aftercare scheme submitted in accordance with an aftercare condition.

- to ascertain whether the steps in an aftercare scheme or an aftercare condition are being taken.

4. WGS Eligibility

FC staff should be in a position where they can reasonably judge the likely success of a WGS application. In assessing a proposal for grant approval it is recommended that information should be requested from applicants at an early stage as evidence of the practical feasibility of the proposal eg assurances that restoration has followed best practice. This could include information which a mineral operator usually provides to local authorities in support of a planning application. Bulletin 110 Appendix 3 covers this in detail and a summary of this is reproduced here as Appendix 1.

In addition to the factors listed in Appendix 1, Soil Quality Surveys (SQS) may be carried out to assess soil thickness, stoniness, soil structure and compactness and levels of contaminants. Further information on SQS and soil-forming materials –their use in land reclaimations is given in the booklet " Creating Community Woodlands on Closed Landfill Sites" (See Section 6 – Sources of Advice)

A table showing the basic requirements for forestry establishment that require to be achieved before grant aid will be considered, are given in Appendix 2.

Applicants may need to consider taking professional advice.

Proposals where insufficient information is known about a site should not be considered for grant aid.

5. The Key Components in WGS Applications

5.1 Site Investigation

Since the history of many derelict sites is incomplete, the main problem is to identify the physical and chemical site factors that present a hindrance to tree establishment. (Site topography can be also be complex and severe.)

A detailed site assessment is thus an essential precursor to the preparation of any restoration proposals. Visual assessment will not normally be enough to identify problems and exploratory work like soil sampling analysis will usually be needed to complement on-site investigations. Some of the main elements which site investigations should identify are:

- soil texture - extremes of texture or dominance of one-size particle has an effect on soil aeration and water holding capacity.

- stone content - extremely stony soils will hinder tree planting and prevent root development.

- compaction - disturbed soils generally suffer from compaction which affects the water regime of the soil and root penetration.

- waterlogging - prevails on areas of slack gradient and/or where water percolation is impeded by the presence of a compact sub-surface layer.

- erosion and stability - steep slopes and landform influence water run-off and erosion risk.

- chemical properties - sites of pH less than 3.5 and more than 8.5 are not suitable for planting. Acidic 'hotspots' and high concentrations of toxic elements (eg arsenic, boron, cadmium, copper, lead mercury) and the presence of pyrite all affect plant growth.

5.2 Site preparation

This is one of the main factors influencing the successful establishment of trees on derelict land.

Ground preparation should only be carried out when the soil is dry (ie not during winter months) and the general aim should be to provide a rootable thickness of 1 metre. Compaction, normally caused by heavy machinery traffic, is one of the primary causes of reclamation failure. Most derelict and abandoned mineral workings will thus require some form of decompaction before planting can take place.

Traditionally this has been done with rip ploughs where the effect is restricted to the top 20 cm and is shortlived. It is now recognised that complete or total cultivation is more effective and would be a requirement for WGS eligibility.

Technical Development Branch has recently produced a technical note on *"Total Cultivation of Compacted Soils on Reclamation Sites" (30/98).* This indicates that on friable soils the profiled strip cultivation method is the cheapest method (approx £500/ha). Costs on heavier soils are higher.

On sites that are being actively restored loose tipping is the preferred method of soil replacement. If carried out properly compaction is avoided.

5.3 Drainage

Since waterlogging has a direct effect on tree growth, drainage of the site is an important prerequisite for successful tree establishment. Complete cultivation and loose tipping will promote good drainage of the site but landform design is most important.

Erosion can also be a risk on steeper slopes or where vegetation cover is sparse.

Reclamation can provide the opportunity for the creation of a landform that will facilitate the control of water flow. The minimum surface gradient for effective

drainage is 1 in 10 (5.5-6%). Unvegetated sites that are flatter than 7% and steeper than 33% should be regraded.

On long slopes the construction of 'berms' (akin to cross drains in conventional forest drainage) is recommended in order to control surface water. They should be of even gradient(< 2 degrees), the width of a bulldozer blade and slope slightly towards the hill.

Water management is a complex issue and professional engineering advice is recommended.

5.4 Nutrients

Satisfactory tree growth and health depend on the availability of sufficient plant nutrients. Very often one of the main problems associated with derelict and mineral sites is a lack of topsoil. Without topsoil sites generally suffer from a shortage of nitrogen and sometimes phosphorus.

Where nutritional deficiencies are present then remedial action will be necessary. However it must be noted that where there are other problems such as waterlogging (perhaps through a compact sub layer) or heavy weed competition then fertilising alone is not a guarantee for success. These other problems will also require to be addressed.

In recent years organic amendments (waste material containing organic matter) have made a significant contribution to reclamation success. The benefits of adding organic matter are firstly raising the nutrient content of the site and secondly improving moisture retention. In these cases moderate to high application rates (ie greater than 50 tonnes dry solid per hectare) usually address the main physical and chemical limitations of tree growth on derelict sites.

It is important that amendments are thoroughly mixed into the soil to achieve an intimate mix between mineral and organic matter. It is also important that the application process is well planned to avoid compaction of the site and enable the protection of watercourses and water features.

Applications of amendments will help to establish a cover of ground vegetation but can also encourage vigorous weed growth. Adequate weeding will thus be required to avoid competition for nutrients and moisture.

5.5 Species Choice

Choice of species should be determined by site conditions such as availability of topsoil, soil wetness, pH, and exposure. If restoration has involved the use of topsoil then more demanding species can be considered but generally undemanding or 'pioneer 'species should be selected (ie rowan, birch, alder, poplar, larch and pine).

Table 6.2 in Bulletin 110 should be followed. The general principle in considering species selection is to avoid an over-reliance on one particular species .

Alders have been widely used in reclamation plantings due to their nitrogen-fixing ability, particularly common alder, as the only native alder species. However since it is now recognised that on derelict land this species is prone to dieback after 5-6 years due to moisture shortage, planting proposals should not stipulate high proportions (>50%) of this species.

Several non-native alders (including grey, red and Italian alder) have shown that they are more tolerant of dry conditions than common alder. Although red alder is particularly good and shows impressive growth on almost all sites other than those susceptible to frost.

Conifers should not be automatically excluded from reclaimed sites. Species such as Scots pine and larch which have fairly modest site requirements can be capable of reasonable growth.

Planting stock specification is also important for best results. The use of planting stock with large root-to-shoot ratios is recommended. The most generally suitable stock types are bare rooted transplants 30-45 cm high in height or cell grown plants 20-40 cm in height.

5.6 Woodland Design

Reclamation provides the opportunity to create a landform that is in keeping with the surrounding landscape. The principles of woodland design are discussed in the Forestry Commission's *Forest Landscape Design Guidelines* and *Community Woodland Design Guidelines.*

5.7 Maintenance

As for all woodland establishment continued maintenance is essential for success. This will involve:

- weeding - to remove competition for water and nutrients. The use of organic amendments will increase the requirement for weed control.

- beating up - it is vital that any failures are replaced (annually if possible) as this will maximise the extent of root development within the soil and provide resistance to compaction; enabling more rapid canopy closure and reducing the exposure suffered by individual plants. Beating up will also reduce maintenance costs by shading out weeds and increasing the visual impact of established woodland. Species demonstrating the highest survival rates should be used for beating up.

- tree protection - plant protection is vital for all tree planting schemes. Individual tree shelters and outer perimeter fencing require to be adequately maintained.

6. Sources of Advice

Reclaiming Disturbed Land for Forestry	FC Bulletin 110* (1994) Andy Moffat and John McNeill
The Potential for Woodland on Urban and Industrial Wasteland in England Wales	FC Technical Paper 29* (2000) Duncan Perry and and John Handley
Tree Establishment on Landfill Sites	N A D Bending and A J Moffat (1997)
Total Cultivation of Compacted Soils on Reclamation Sites	Technical Note 30/98^ (1999)
Creating Community Woodlands on Closed Landfill Sites	Project undertaken by Mersey & Red Rose Forest #

National Planning Policy Guidelines - NPPG 4 Land for Mineral Working (produced by Scottish Executive)

*Forestry Commission publications can be ordered from: Forestry Commission Publications, PO Box 25, Wetherby, West Yorkshire, LS23 7EW Tel: 0870 121 4180

^Technical Development Branch publications are available from: Forestry Commission,Technical Development Branch, Ae Village, Dumfries, DG1 1QB Tel: 01387 860264

Contact The Mersey Forest Offices, Risley Moss, Ordnance Avenue, Birchwood, Warrington WA3 6QX. Tel:01925 816217

Guidance Notes are produced to help FC National Office for Scotland staff deal with a range of subjects. They are freely available, on request, to owners, managers and agents in order to help them in the preparation of WGS applications etc.

Some Guidance Notes deal with well-developed topics. Other Guidance Notes cover subjects which are fast moving, with fairly rapid accumulation of new knowledge and experience.

Please remember that Guidance Notes are intended to help, but are not necessarily the 'last word' on the subject. They will be updated as necessary. Any comments or feedback would be welcome. Please pass your comments to the FC National Office for Scotland, 231 Corstorphine Road, Edinburgh, EH12 7AR, Tel 0131 334 0303

Appendix 1

Restoration Checklist (From Bulletin 110)

This includes information which a mineral operator might provide to mineral planning authorities in support of a planning application which include the provision for reclamation to a forestry end-use.

Although the list of items below should be treated as guidance, it is recommended that staff should require this information before determining WGS suitability.

1. A copy of the relevant planning application.

2. An Ordnance Survey plan of the area (Scale1:10,000) indicating:

    - the outer boundaries of the area to be excavated
    - the outer boundaries of the total site so that areas located for topsoil and subsoil can be seen.
    - details of any existing topsoil, subsoil or soil-forming materials mounds that may be used in the restoration, including postion, types and quatities available.

3. Details of the type and depth of proposed workings and volumes of materials to be removed. Details resulting from geological or hydrological investigations including water-table levels, nature and thickness of soil-forming materials, and depth and nature of topsoils, subsoils and overburden.

4. A strategic plan showing the type of proposed reclamation to forestry, including:

    - projected plan of contours and final levels of the site, together with information about soil-forming materials, subsoil and topsoil depths.
    - phasing and timescale of the working, restoration and aftercare
    - methods of filling, where appropriate; types of fill and materials proposed
    - methods of stripping, transporting and restoring soils, including proposals for soil and machine movement, where appropriate
    - proposed outfall for drainage of the restored land and proposals for creation of any permanent water areas
    - proposed access roads.

Appendix 2

Minimum Standards for Establishment of Woodlands on Mineral Working and Derelict Sites

Assessment	**Minimum Standard**	**Remediation Option**
Soil Thickness	1.0 metre	Import soils or SFM
Stoniness	**<**40% by volume, few stones greater than 100mm in size	Import soils or SFM
Compactness	Loosening to a depth of 1 metre (Dry bulk density of , <1.5 gcm³ to 0.5m and, <1.7 gcm³ to 1 metre)	Consider total cultivation methods (see TDB Technical Note 30/98)
Soil pH	3.5 – 8.5	Remedial Options if pH <3.5 or >8.5 i)mix with imported material ii)add lime or equivalent (if pH< 3.5) iii) reject affected areas for woodland
Drainage	Slopes between 7% and 33%	Regrade site
Contaminants (Phytotoxic and zootoxic)	Not excessively over ICRCL* levels (see Bulletin 110)	Select tolerant species. Import soils to cover hotspots.

*Interdepartmental Committee on the Redevelopment of Contaminated Land