**Application | Soil Storage**

**Ref:** CHECKED

Please see Annex AP10 for supporting information, and the "Introduction" for Health and Safety considerations and advice on the use of the guidance.

1. **Is soil storage required**

2. **Are the storage locations clearly identified in all documents**
   a. do these locations need to change through the life of the site
   b. how long will the soil be in store
   c. are soil bunds sited to avoid damage from other operations
   d. are soil bunds located away from areas likely to be flooded
   e. are separate soil bunds identified for different soil types

3. **What bund construction details are provided**
   a. what time of year is the soil to be placed into store
   b. what is proposed for the soil beneath the bunds
   c. how are the bunds to be formed
   d. what are the dimensions (height, slope, volume) of the bunds

4. **How are the bunds to be managed**
   a. how are weeds to be controlled
   b. are the bunds to be vegetated
   c. what record keeping (and auditing) is proposed

5. **What bund removal details are provided**
   a. treatment of surface under the bund
   b. blending with surrounding landform

**COMMENTS**

For more detailed information see:
- Evaluation of Mineral Sites Restored to Agriculture (LRA 2000)
- Good Practice Guide for Handling Soils (MAFF April 2000)

Cross references:
- RN 4, 8
1. Is soil storage required

Ideally, soil is stripped from one part of a site and immediately spread over a worked area elsewhere on site (the direct, progressive restoration method). This saves handling costs and storage problems. Soil storage necessitates additional handling that can lead to a greater risk of compaction. Risk to the soil during storage also arises through the potential mixing/dilution of the soil types, and potential chemical and biological degradation. These are fully explained in the Land Research Associates work for MAFF entitled ‘Evaluation of Mineral Sites Restored to Agriculture’ (LRA 2000). However, on most sites, soil storage is a necessity with mineral extraction occurring in a sequence of phases, each phase often representing one year’s production of minerals. Whilst one phase is being worked, another can be prepared for working and a previous phase can be undergoing reclamation. In order to get such a rolling programme underway, soil from the first 2-3 phases will need to be put into stockpiles. Soil can then be stripped from the next phase to be worked for minerals and carried directly to worked-out land that has been brought up to finished levels ready for soil placement. On longer-term hard rock or chalk quarries, soil storage will be required sometimes throughout the whole life of the site and therefore, good record keeping is vital.

2. Are the storage locations clearly identified in all documents

In examining the application details and working proposals, it is important to keep an overall picture of the effect of different operations on the soil storage proposals. Inconsistency between drawings or omissions can lead to subsequent difficulties on site.

   a. do these locations need to change through the life of the site
      A scheme that includes the relocation of soil bunds from one area to another may increase damage to soil and mixing of different soil types.

   b. how long will the soil be in store
      Stored soil may remain in the stockpiles for periods ranging from a few months to several years. Very long-term soil storage presents the danger of the bund being assimilated into the landscape and becoming a forgotten resource. Careful site planning and record keeping should ensure the soil remains available for restoration.

   c. are soil bunds sited to avoid damage from other operations
      Vehicles should be kept to prearranged routes to and from storage areas to prevent trafficking of areas still to be stripped of soil or restored land. The bunds themselves should be placed in a location where there will be no routine traffic passing over them. Storage should not be proposed too close to the excavation area where soil may be lost through slippage in to the void, or close to hedges that will result in losses. Steps should be taken to ensure that any fuel storage on the site cannot contaminate soil storage areas.
d. are soil bunds located away from areas likely to be flooded
The bunds should be sited on dry ground, not in hollows and should not disrupt local surface drainage. Where necessary, bunds should be protected from run-off/ponding by a cut-off ditch which is linked to appropriate water discharge facilities. Within flood plains, the orientation of the bunds may require consultation with the Environment Agency.

e. are separate soil bunds identified for different soil types
The application should clearly identify, with annotations on the plans or by cross-reference to the soil details, the specific location of each soil bund and what it is intended to contain. Bunds of differing materials should be physically separate. Separation will be required for the differing topsoil and subsoil units. In addition, specific areas should be allocated for the storage of any soil-forming material that requires separate storage from the overburden. Separate locations may be required for any contaminated soil or soil of particular ecological interest. Therefore, it is likely that there will need to be numerous separate topsoil and subsoil bunds due to the differing characteristics. The past practices of skimming subsoil and overburden bunds with topsoil to encourage growth on the bunds is not acceptable. The overlapping of soil bunds is not acceptable. On a continuous soil bund required for noise or visual attenuation, a change in soil type would be acceptable, providing a vertical interface is physically established using a geomembrane (or similar material) and marker posts are provided with locations surveyed and recorded.

3. What bund construction details are provided

a. what time of year is the soil to be placed into store
Soil should not be put into store during winter months when the weather is unsuitable and the soil too wet to be handled without being damaged. A wet soil is likely to suffer more in a stockpile than a dry soil. A wet clay is not only considerably heavier than a dry clay, thereby increasing the load on all soil below it, but also has a lower shear strength and is thus less able to resist any applied load. A wet, sandy soil is more likely to slake (the effect of inter-particle lubrication allowing them to move and pack more closely) in storage than a dry sandy soil. Conversely, the construction of soil bunds in dry weather can create dust problems.

b. what is proposed for the soil beneath the bunds
The general principle is that each storage bund should be stored on like material. Therefore, overburden storage areas require both the topsoil and subsoil to be removed before placement into storage; subsoil bunds require topsoil to be removed and topsoil bunds can be directly placed upon the existing topsoil. If the landform is to alter and regrading is required, then other options should be considered.
c. how are the bunds to be formed
The bunds should be stable structures from which water will run off without causing erosion or instability. Slopes in excess of 45° are usually regarded as unstable. However slopes at angles less than 25° may reduce drainage from the bund. Soil type and climate are therefore factors to consider when determining the size and cross section for each bund. The proposals for constructing the bunds should ensure that equipment will be able to operate safely and effectively, without causing further undue compaction, yet maintain the stability of the structure. The construction of bunds using motor-scrapers which build the height up in shallow incremental layers ensures stability but results in compact bunds. The soil deposited by all techniques requires careful management to avoid undue trafficking. Further guidance is available in Good Practice Guide for Handling Soils (MAFF April 2000).

d. what are the dimensions (height, slope, volume) of the bunds
The magnitude of the compacting and consolidating forces will depend on the height of the storage bund and the length of time the soil is stored; but the effect of these forces will depend on the texture, density and moisture content of the soil within it. Soil that is placed into a bund will be subject to the consolidating load of all the soil above it. In a bund, soil is buried under a much greater weight of soil than experienced in natural conditions. The direct effect of stockpiling is, therefore, compaction, in which the air-filled pores of a soil are closed and consolidation, which involves a movement of moisture out of the finer pores, enabling the soil particles to move closer together. Both processes result in an increase in density and a reduction in porosity. The ideal storage bund from a soil protection aspect is therefore likely to be a very low and wide structure, where the total storage profile benefits from the roots of surface vegetation. It is accepted that such a scenario would require extensive areas for soil storage, and may not enable the bunds to be utilised for noise or visual attenuation. The shape and height is therefore, a compromise. There will be soil in the core of the store that will be subject to increased loads and suffer structural deterioration that will have to be addressed within the restoration and aftercare period. The application details should clearly identify the height and dimension of all the bunds, to ascertain both the likely storage effects upon the soil itself, and whether the volumes calculated can be physically stored in the space identified. The side slopes of soil storage bunds are often 1:1½, with the outer slopes being 1:3, which enables space, stability and maintenance issues to be addressed.

4. How are the bunds to be managed

a. how are weeds to be controlled
The bunds need to be accessible to undertake weeding and mechanical mowing at the appropriate time of year to prevent weed infestation.
b. are the bunds to be vegetated
   If the bund is to remain for more than a few months, or over the winter period, then it should be vegetated and kept weed free. The seed mix details and method of sowing may be different to normal grass sowing techniques – mowing should occur at least twice a year (dependant upon seed mix), and spraying undertaken to prevent a build up of weed seeds. The vegetation of the bund enables unauthorised movement of soil to be noticeable and assists in preventing soil erosion.

c. what record keeping (and auditing) is proposed
   The soil handling strategy should identify all the likely future storage operations, and their approximate timing. A record should be established and maintained for each soil bund. Through the life of an operating site, the personnel involved from both the operating company and MPA is likely to change. Therefore, a clear record of operations including dates, volumes, types of soil, area from where the material originated, weather conditions during stripping and other problems encountered will assist in future decision making. The labelling of the individual bunds is good practice. All the information should be readily available to the operators on the site. The intention to undertake an annual audit will enable a clear, ongoing understanding of the quantities, qualities and locations of soil resources either stripped, remaining unstripped or replaced against the required restoration objectives.

5. What bund removal details are provided

a. treatment of surface under the bund
   The application should include proposals for soil loosening under the bunds when the stored soil has been removed and a restored soil profile is being re-established.

b. blending with surrounding landform
   The width of a bund can be significant and the levels may require alteration over an area greater than the excavation area in order to achieve the desired landform. The application should highlight how the bund removal, landform changes and soil replacement will be achieved.