Deep Trench Bunds - Method of Installation
Restoration Technique 5

(This method of installation should be read in conjunction with Peatland Re-wetting Design Specification Sheet – 05 – Deep Trench Bunds)

Deep trench bunds are a re-wetting technique installed on degraded peat bogs where the general peat watertable is low. The technique is suited for sites where there is open vegetation but the peat is damaged from deep drains or a high density of drains. It is best used on peat habitat damaged from peat extraction sites (hand cutting or milled surface), dense scrub, natural woodland or forestry plantation ground. This is the most appropriate bunding technique to seal the underground peat cracks or peat pipes on peat edge features including peat cut face, peat haggs or peat slopes.

The main aim of the deep trench bund is to restrict sub-surface water flow, with a top bund slowing surface water movement. On highly damaged sites ditches, peat cracks, slumping or tree-root damage draw water away from the peat surface and this restricts peat forming conditions. The deep trench restricts the water loss by creating an underground 'wall' of wet 'putty' peat which slows water movement. This improves hydrological connectivity and re-hydrates the entire peat resource with improved general watertable conditions. The long-term improvement in peat surface wetness should lead to peat forming conditions for suitable peat forming vegetation.

Deep Trench Location

The technique of installing the deep trench will vary depending on the site location and peat surface conditions. Although the trench procedure is maintained the bund shape above ground does alter with the ground conditions. The shape is mainly determined by the surface gradient and location to other features on site.

On peat slopes or re-profiled edges the usual bund layout will be individual bunds with bund fingers. The aim for the bund is to push water back up the slope and stop lateral movement. The bunds should be installed at the correct location to achieve general peat re-wetting with a general rule of a 30cm fall in gradient between bunds. On areas where the gradient is less steep or there is generally only one fall across the surface, bunded cells can be considered. The aim of the cells is to retain water within the cell and spread the re-wetting across a wide area. To achieve this, bunded cells of different sizes and shapes are installed. Since the bunded cells are linked it is essential the trench below ground is connected to create a peat seal.

Deep trench bunds generally are used from 0.5m down to 3.5m and require a borrow pit to supply additional wet 'putty' peat. The top bund is generally 30cm high above the peat surface but some bottom bunds on peat slopes are higher up to 50cm. To ensure there is some structural strength and to improve water retention the bund peat should be 80-90cm wide. With the vegetation placed back on top the bund may be wider. The general shape of the bunded cells ranges from 10m^2 up to 40m^2 or variations on this, with some being rectangle or crescent shape.

The deep trench technique differs from the shallow bund technique by three points. Firstly, the trench is dug deeper with the peat taken out to expose the water loss features. Secondly, to achieve the best results two excavators are used. One machine excavates the trench using an 800-900mm wide digging bucket (with teeth) the second machine creates the top bund wide ditching bucket (no teeth). If using one excavator, the machine will need to swap between both types of bucket. Thirdly, the deep trench technique requires the digging of a borrow pit to provide wet 'putty' peat for the core of the peat bund.

For reference, where the ground has open vegetation but is only slightly damaged by small ditches but does require improvements in the water table the shallow bund technique will usually be adequate (*Technique 4*).

Installation Procedure

- The bunding design will determine the bund shape and the gradient will determine if they are bunds with fingers or bunded cells.
- The operator should walk the line of the bund and set out the line with marker canes. The bund should aim to follow a set contour to maintain a fixed height along the top of the bund. The bund should aim to be 90 degrees to the peat slope to ensure best water retention.
- The excavator straddles the line of the trench and digs the trench towards the machine. This allows the excavator operator to see down the trench and enable the machine to dig deeper into the trench.
- To begin the operation there is a requirement to undertake an inspection dig to identify the depth of the water loss feature within the peat. This will assist in determining the average depth the trench bund is to be dug out. The inspection dig should be a trench 5-10m long and dig down deep enough to identify the condition of the peat and the depth of the water loss. Once this has been identified the following procedure is undertaken.
- The excavator first scrapes off the top vegetation and places this to one side, exposing the degraded peat. The degraded peat is dug up and placed to one side, this usually the depth of a digger bucket.
- The operator continues to dig in to the trench until the water loss features are observed or the wet 'putty' peat is exposed. For some sites there may be a requirement to dig down and take out the peat for use later.

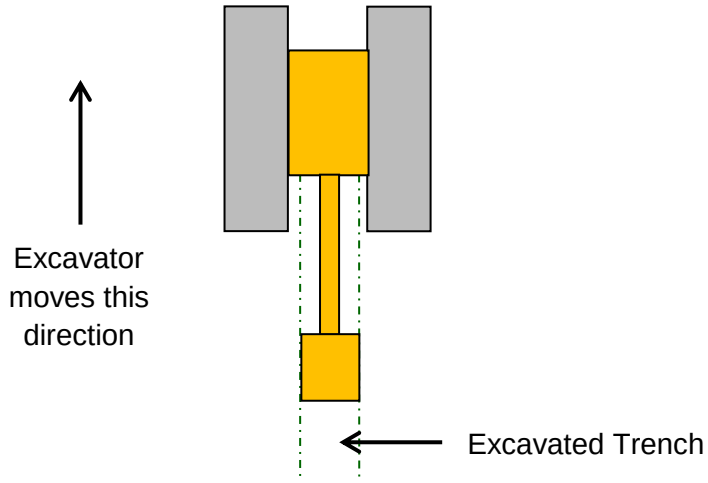

Fig.1
Simple diagram showing excavator straddling the trench and digging the trench towards the machine.

- Once the water loss depth has been observed the excavator digs down about a bucket's depth and turns the peat upside down. The peat is firmly compacted with the back of the digger bucket, to create a seal. Using the digging bucket and the excavator straddling the trench allows for better compaction of the peat and improves the sealing effect of the peat.
- The peat in the bund core is built up with additional wet 'putty' peat. Wet 'putty' peat is taken out of a borrow pit dug upslope of the trench. Each bucket full is put in to the trench and firmly compacted to create a seal. This is undertaken until the peat is built up to the vegetated surface. At this point the first machine has completed its operation.
- To create the above surface bund the second machine moves to the side of the trench. Using a wide ditching bucket (1.2-1.5m wide) the excavator places one bucket of wet 'putty' peat (from the borrow pit) on to the trench and begins to shape a bund. The excavator then places the degraded peat on top of the wet putty peat and presses down firmly. The operator shapes the surface bund in line with the standard specification, and ensures each bucket-full is pressed firmly. The final height of the peat bund is an average height of 250mm-300mm above the peat surface.
- To complete the surface bund, the excavated turf is re-laid on top and pressed down firmly.
- To complete the operation the borrow pit is filled in and the sides levelled and made as shallow as possible, with surplus vegetation put back in. The operator also generally flattens the surrounding area to reduce the impact to the peat surface.

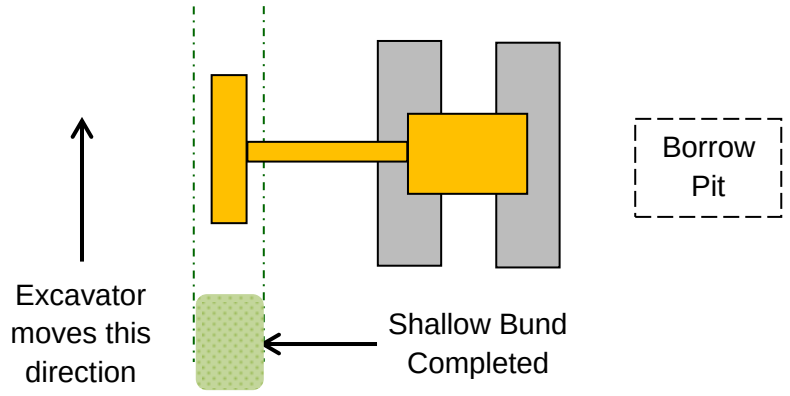

Fig. 2
Simple diagram showing an excavator aligned to the side of the trench at 90 degrees to complete the surface bund. The machine finishes off the bund and fills in the borrow pit.

Additional Installation Procedure

- If installing deep trench bunds with bund fingers the first excavator digs out both the bund and bund finger as per the procedure above. The bund line is according to the topography of the land. The bund should be placed at 90 degrees to the slope, to ensure best water retention. The first excavator ensures the bund and bund finger are joined correctly and the peat is firmly pressed in place to create an underground seal. Bund fingers are installed at 90 degrees to the main bund to ensure there is no lateral water movement.
- The bund finger is usually about 5-8m in length up the slope. The second machine finishes off the surface bund as above.
- If installing bunded cells the first excavator must link all the sides of the cell to ensure the peat is sealed underground. The shape is determined by the site conditions and both machines complete their operation as per the above specification. Each cell must be joined to the next cell by firmly pressing peat at each connecting bund.

Fig. 3
Photo shows the finished deep trench with peat firmly compacted down, ready for the surface bund to be shaped on top.

Fig. 4
Deep trench bund with bund fingers on a lowland raised bog (SSSI site)

NOTE: The water collects in the borrow pit first. The bund is set against the slope with the finger coming off at 90 degrees.

Fig. 5
Bunded cells using the deep trench technique on a lowland raised bog (SSSI site). The cells are 10m x 10m and are set against the slope to achieve maximum water retention.

NOTE: the vegetation developing on the bunds is growing 1 year on, following installation.

Machinery & Equipment

All machinery must be low ground-pressure tracked machines with a PSI below 3.5. Bio-hydraulic oils must be used and the machines should be clean and free of oil/fuel leaks. Some locations may require the use of bog mats to work on very wet ground. Deep trench bunds often require excavators in the 5-10 tonne range. Digger buckets should be chosen appropriately, according to the size of the bund required