



## Soil Tech, Inc.

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### **4. Post Mining Land Management**

Rehabilitated cropland fields require careful management during the initial years following reconstruction. Mining companies in the US have a minimum five year responsibility period for prime farmland reclamation. The management period starts when the first crop is planted, and the bond can be released after five years if the required target yields have been demonstrated.

The initial crop planted on rehabilitated soils is typically small grain, such as wheat, rye, or millet, depending on the season when topsoil is replaced. Contour terrace berms with down drains are usually installed when the soil is being placed to reduce slope length and to help control erosion during the early years when the mine soil structure is redeveloping. Mulch may be needed on steeper slopes to provide early protection to the young seedlings and to help protect topsoil from erosion. The goal is to get vegetative cover as soon as possible to stabilize the topsoil.

Reclaimed farm fields can have uneven settling that will occur over time. This settling can cause depressions that will pond water and require additional grading. Cropland fields are typically reclaimed in the 1 to 4 percent range to allow for easier grading to correct for uneven spoil settling. These gentle slopes can be managed with minimal land leveling and can be deep tilled or ripped without serious erosion problems.

**Organic matter additions** – One of the most effective management tools available to the reclamation agronomist is animal manure. It provides both plant nutrients and organic matter essential for biological activity in the developing soils. Reclaimed farm fields that have received poultry manure recover faster from the shock of reconstruction and have better crop yields when compared with farm fields that do not receive manure. Large quantities of manure are needed and availability can be an issue, but manure is a valuable resource when applied to the mine soils.

**Conservation practices** – Drainage control structures are needed to manage erosion on longer slopes. Steeper slopes may require terraces or berm structures to be installed to stabilize the soil. Mine soils tend to be highly erodible and will benefit from a cover crop of legumes and grasses.

Cover crops are an important management tool to reduce the erosion potential. Managing an area as a hay field for several years will build organic matter and reduce soil erodibility. Conservation tillage should be implemented on reclaimed farm fields. A residue ground cover of 30 to 70 percent is needed to provide maximum protection against wind and water erosion. Minimum or reduced tillage operations should be used to reduce exposure of rehabilitated soils to erosion and to enhance infiltration and movement of water into the soil.

Residue management is important year-round as part of a conservation system to support reduced erosion, maintain tilth, conserve soil moisture, and reduce off-site transport of sediment and nutrients.

**Compaction** – Rehabilitated mine soils are subject to mechanical re-compaction, so equipment usage should be minimized. Tillage operations should be done when the soil is dry. Working the soils when wet is not recommended as this can increase compaction problems. Deep-rooted legumes can be used to help dry subsoils so that deep tillage can be more effective in loosening compaction. Caution should be taken when using ripping, because when a field is deep tilled it may act as a sponge down to the depth of the ripper.

**Plant-available water** – Rehabilitated soils are more sensitive to drought stress than unmined soil. Newly reclaimed farm fields do not have the plumbing system of macropores that allow plant roots to easily explore the full depth of the rootzone. The reduced volume of soil available for water removal causes plants to be more stressed during dry periods. Tillage and natural cycles of shrink-swell can, with time, enhance the soil volume explored by plant roots and improve the amount of water available to the crops. Timely rains during the growing season are helpful for maximum crop production. Increasing the effectiveness of precipitation can be improved by the proper use and application of conservation practices.

**Conservation Tillage** – During the first few years, most fields require some tillage and grading to account for land settling and rill erosion. After the field is in normal production, conservation tillage practices are an option. Since water management is the key to crop production on rehabilitated mine soils, any farm practice that encourages water conservation in the soil profile should be considered. Conservation tillage practices, such as mulch till, ridge till, no-till, or strip till systems all encourage moisture conservation in the profile. Managing the amount, orientation, and distribution of crop residue on soil surface year-round can conserve moisture needed for crop production.

**Contouring** – Planting and tilling performed on the contour of the farm field slope can reduce erosion, reduce transport of sediment, and increase infiltration of moisture. Contour tillage is most effective on slopes between 2 and 10 percent.

**Terracing** – Contour earth embankments and channels constructed across a field slope are a management practice that can reduce soil erosion and conserve moisture. The key to installing and managing contour berms is to provide a stable down slope outlet channel or pipe that can safely move the water to the base of the slope.

Water and Sediment Control Basin (WASCOB) with an inlet pipe above an earthen berm can be utilized to safely take the water down the slope in a pipe. Management of down drains is important following storms to quickly clear any inlet blockage or to repair any berm damage. WASCOBs are used to control erosion in small drainage channels, whereas terraces are used to control water flow on long slopes.

**Grassed Waterway** – A constructed channel established with suitable vegetation can be used to safely move water down a slope without causing erosion, flooding or ponding. Vegetative filter strips can also be used to reduce suspended solids moving into streams.

**Crop Management** – Crop selection and management can reduce the effects of moisture stress through hybrid selection and through crop rotation. Corn hybrids on reclaimed soils tend to pollinate later in the season than on undisturbed soils. Soybean hybrids with a longer

fall season can help productivity. Using hybrids that are productive over a wide range of conditions and are able to cope with droughty conditions is best. Soybeans are more tolerant than corn of a variety of moisture conditions. Plant populations are often reduced slightly compared to non-mined land. Also, timing of planting is more critical, since favorable windows can be shorter on reclaimed soils.



**Rehabilitated mined land in southern Illinois**

Consider using crops that produce lots of vegetation and litter. Adding more organic matter to the soil will benefit production, as well as benefit the populations of soil fauna and flora. As stated above, additions of animal manure are beneficial to mine soils both for their nutrient content and for stimulation of the microbial populations that are important for good plant vigor.



**Corn grown on rehabilitated farmland near Farmersburg, Indiana**

Crop rotations should be planned to maximize productivity, but also to take into account the potential for higher erosion on the rehabilitated soils. Initial crops should be used to increase

the organic matter and build soil structure. Root structure of the crops should be considered for their ability to enhance organic matter production and improve soil health and structure.

**Soil Testing** – Nutrient additions to mine soils should be based on soil testing results, just as for unmined soils. Foliar testing may be needed to evaluate the crop response to micronutrient balance. Consider foliar testing every three years or when a specific problem is noticed.

Management of mine soils is a challenge. Newly reconstructed soils are subject to erosion and can be droughty. Plants can struggle to extend their roots deep into the soil profile to obtain needed water. Biological communities are being re-established in the topsoil, especially if the soil has been stockpiled. However, with good conservation practices and agronomic management, the mine soils can be brought back into crop production so that harvesting the coal resource can be considered to be a short-term land use.