Kyanite Mining Corporation
2022 DMM / VTCA Reclamation Award Nomination

The East Ridge Plant began operations in 1978 and is one of two quarries operated by Kyanite Mining Corporation (KMC) at its Willis Mountain Complex. The Plant is the world's most technologically advanced producer of the industrial mineral kyanite. Since 1993, plant refuse has been deposited at the East Ridge Hollow Fill. Now, 30 years after its inception, the Hollow Fill has been completed.

Northeast slopes viewed toward the west.

East Ridge Hollow Fill

In this aerial photo from the mid-1990's, the Hollow Fill can be seen a few years into its lifespan. The Hollow Fill was developed as a 15-acre tailings disposal area north of the East Ridge Plant.

The fill was started behind a sediment control dam. One of the first sediment control dams can be seen in the aerial photo impounding storm water behind the northeastern slope.

Concurrent reclamation began in the mid-1990's, shortly after the structure was started. As each level of the waste disposal area was completed, another control dam was constructed. These dams evolved into drainage benches used to convey runoff, via riprap groin ditches, to sediment basins below the toe. The top of each sediment control dam became the drainage bench on the terraced slope shown here.

Fill Placement and Concurrent Reclamation Continue

Sediment control dams, constructed downgradient of every phase of fill expansion, ensured that KMC captured runoff and prevented the loss of eroded material.

In the early 2000's, KMC extended the perimeter dam around the west side of the fill and continued to raise the height of the fill.

As the upper slopes reached capacity, they were graded down to the interior crest of the control dams, on maximum 3:1 grades.

The reclaimed outslopes evolved into the terraced slopes seen here on the northeastern face of the fill.

Sediment Control Dams

Fill placement began with construction of sediment control dams around the perimeter of the fill. The starter dams were constructed of select native soil that was spread and compacted in lifts on a clean and competent substrate. Keyways were excavated under the dams prior to the placement of material.

Sediment Control and Material Placement

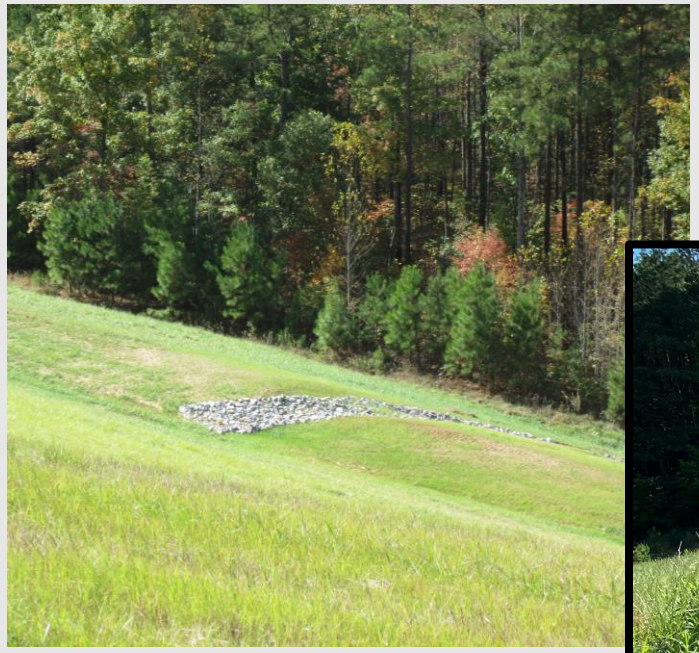
The starter dams provided perimeter drainage and sediment control, diverting runoff to perimeter sediment basins. Care was taken to place coarser, drier tails near the working face of the fill. Finer, wetter tails were placed further from the working face to allow more drying time before being incorporated into the rest of the fill.

Slope Drainage

To shed water, KMC first tried open channel, rock-lined drains, but found them prone to erosion and difficult to navigate with maintenance equipment. The company then switched to pipe slope drains.

The surface area draining to each pipe determined the location and pipe size.

Whether armored by rip rap (top) or concrete (bottom), KMC prefers to bury their slope drains to facilitate long-term maintenance of the fill.



Westward Expansion

In the late 2000's, KMC expanded the fill farther to the west with a new sediment control dam at the fill's far, western edge.

The terraced, northeastern slopes have been completed and reclaimed.

KMC began to experiment with the long slope reclamation method on the northern ridge of the fill.

KMC began discussing vertical expansion with the Division of Mineral Mining.

Southwest Expansion

In 2012, KMC expanded the fill to the southwest behind another sediment control dam. By now, the fill had expanded to 55 acres.

In addition to annual fertilization, KMC amends the reclaimed areas with Class A wood ash, sourced from a local paper mill. As seen here, a healthy vegetative cover is the result.

In late 2011, KMC commissioned a geotechnical study, complete with cone penetrometer soundings, to ensure the foundation could support a 40-foot height increase.

The foundation proved solid. This photo shows the first of two, 20-foot height increases under construction behind the original northeastern slope.

Long Slope Reclamation

In 2011, KMC proposed the use of a long slope above the northwestern starter dam.

Through appropriate planning and careful implementation, an 80 foot tall long slope was completed without stability problems or excessive erosion.

As a result, another request was granted, in 2015, to extend the long slope along the entire western slope of the fill.

The long slopes aid in maintenance of the fill by increasing mower stability, reducing mower scalp on the underlying vegetation, aiding in annual lime application, and eliminating differential settling and water retention in drainage benches. Positive drainage also minimizes acid seeps.

Evolution of a long slope

Long slopes on the western side of the East Ridge Hollow Fill resist erosion just as well as the benched, northeastern slopes.

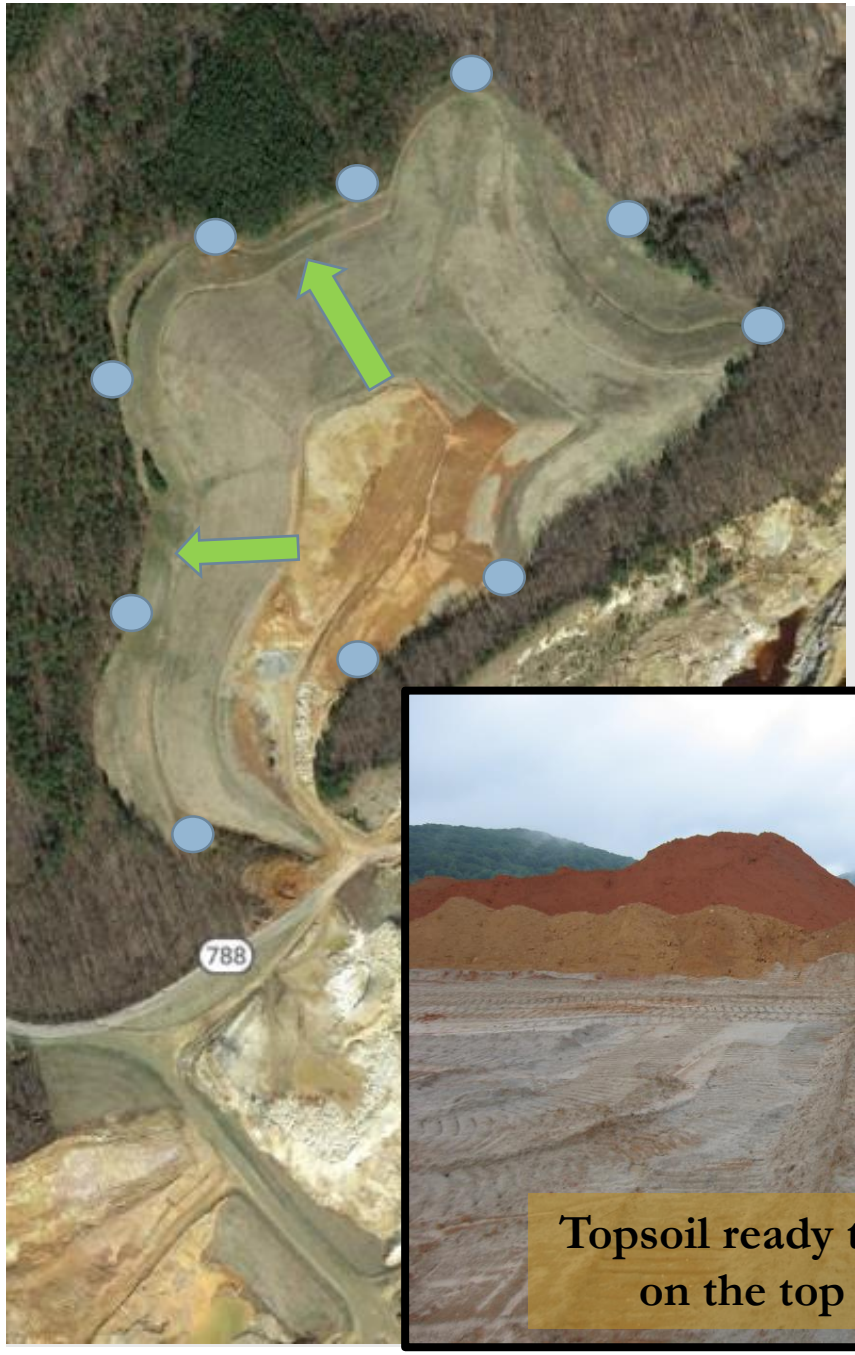
To minimize erosion during final grading and topsoil placement, KMC constructed the long slopes in two levels, or phases. As soon as the first level was roughed in, slopes were placed on grade, covered with topsoil, and seeded. When the next level of the long slope was completed, it was tied into the lower level on the same grade.

Material placement behind starter dam.

First phase is completed. Second has started.

Second phase graded and capped with topsoil.

Second phase reclaimed. Setback started before additional height added to fill.



Outslopes Completed

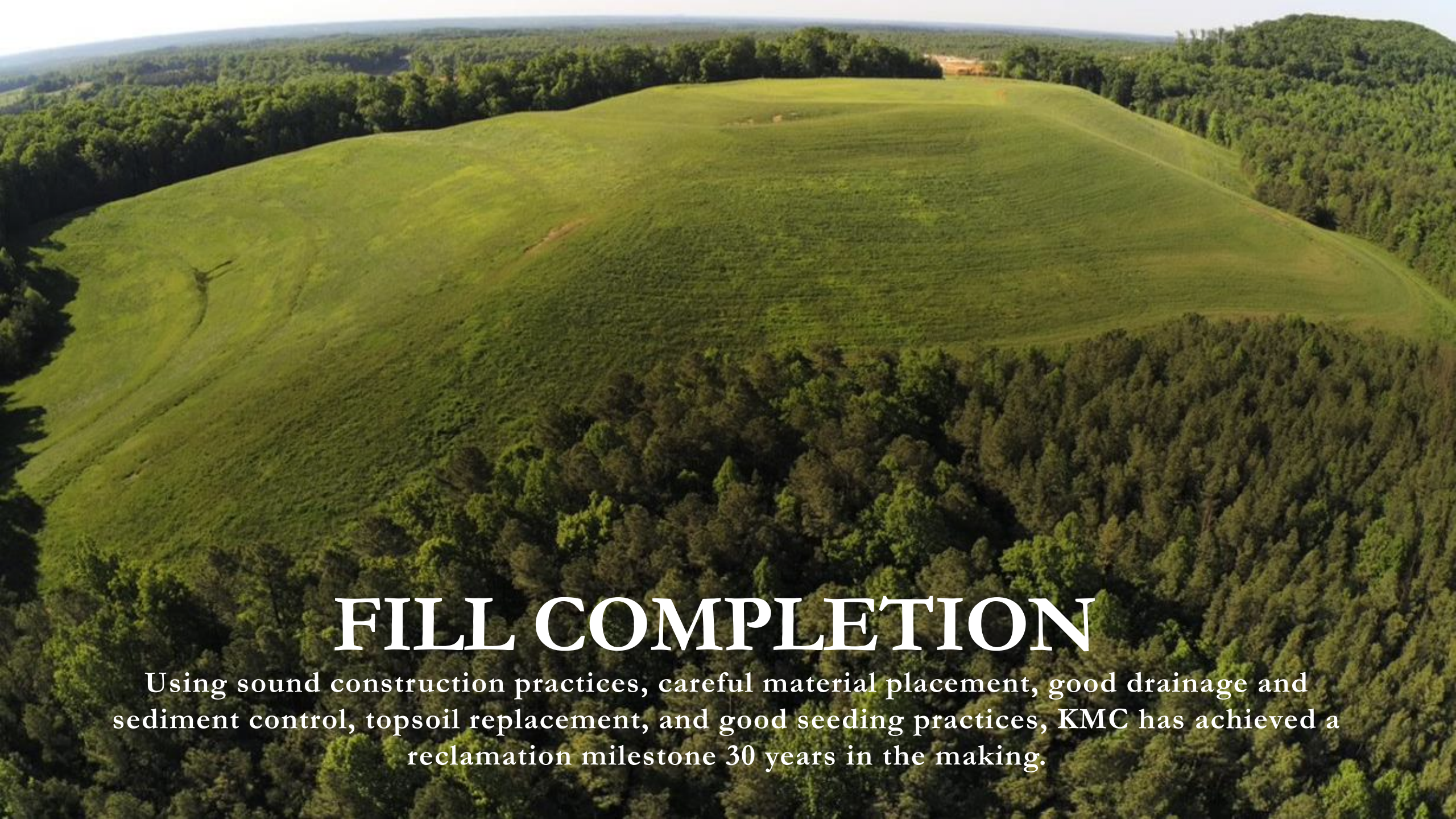
KMC reclaimed the remaining western slopes using the long slope method.

Load limitations required KMC to complete the northeastern slopes using the terraced setbacks.

Seen here in 2019, the surface of the fill has reached its maximum height. Top surface grading has been completed and topsoil spreading has begun.

Storm water runoff is diverted to the sediment control structures by the crest of the former sediment control dams. Multiple sediment traps were embedded around the perimeter of the fill to capture runoff from the outslopes and top surface of the fill.

Topsoil ready to be spread on the top surface.



FILL COMPLETION

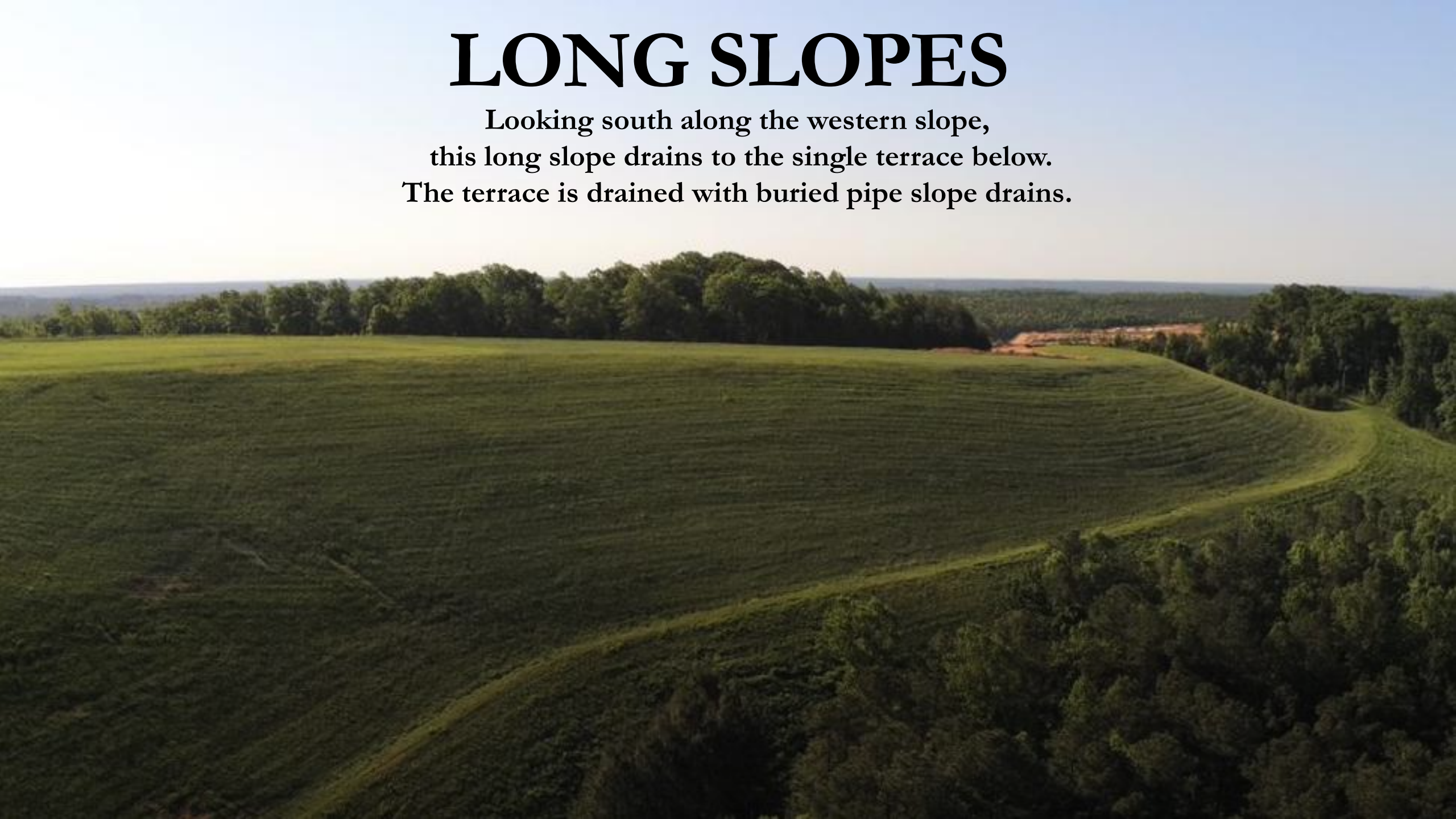
Using sound construction practices, careful material placement, good drainage and sediment control, topsoil replacement, and good seeding practices, KMC has achieved a reclamation milestone 30 years in the making.

TERRACED SLOPES

Looking north, this photo captures the remnants of each sediment dam that KMC built.
As the height increased, these control structures became the terraces seen here.
These terraces drain to a rock-lined groin ditch and buried pipe slope drains.

LONG SLOPES

**Looking south along the western slope,
this long slope drains to the single terrace below.
The terrace is drained with buried pipe slope drains.**



Two photos from the same perspective with the East Ridge in the background.

KMC'S ENVIRONMENTAL STEWARDSHIP… A MINING SUCCESS STORY, WORTHY OF RECOGNITION