The GEOWEB system was filled with angular on-site mine waste rock to provide lateral load reinforcement.

The tailings over the GEOWEB base layer extended to a height of 40 feet.
The reclamation of Moon Creek had six primary construction elements:

1. Removal of an estimated 88,000 cubic yards flotation tailings, contaminated soils, and waste rock
2. Construction of an onsite combined waste containment to safely contain these materials
3. Closure of the mine workings (shafts and adits)
4. Rehabilitation of about 3,300 feet of stream and adjacent riparian zone
5. Construction of a wetlands buffer
6. Installation of measures to stabilize the site following reclamation

STABILIZING THE BASE OF THE TAILINGS CONTAINMENT

The containment features a special foundation that allows its construction on top of the soft, saturated in-situ tailings. Foundation elements included an impervious below-grade scour protection berm, gravel and limestone wick drains within the tailings to allow de-watering, and a GEOWEB® mattress filled with waste rock to provide a surcharge over the tailings and to provide lateral load reinforcement. Waste rock material was mixed with the fine-grained tailings as they were placed in the containment, to improve work-ability and help accelerate de-watering. The containment was covered with an engineered cap that included a geosynthetic clay liner, overlain by a gravel drainage layer, and two feet of soil. An erosion protection mat was also installed to help stabilize the containment, and to provide root matrix reinforcement for the native grasses used in the seed mixture.

PROJECT RESULTS

The final repository was 800 feet in length, by 220 feet in width, and 40 ft in height to hold a total volume of 130,000 cubic yards. The Contractor’s careful attention to de-watering, mixing, and placing material in the containment allowed the project to take full advantage of the flexible elements of the design.

The final cost for this project was $1.9 million—within the range of the original estimate. The total project cost fell within nine 9 percent of the original bid amount even though 50% more waste materials were handled. Offsetting savings were developed in many areas, such as mixing growth media, and reducing backfill in the new floodplain.
Project LESSONS LEARNED:
Many lessons were learned on this project including the four key lessons noted below.

Effective Water Control Key to Construction:
Tailings can form an effective aquitard. In this case, removing the layers of tailings freed the ground water to flow along historic springs and along the valley. This reflected a change to the ground water paths originally identified in the characterization effort. It also required innovative construction sequencing and additional water handling measures such as interim french drains.

Workability Challenges of the Saturated Tailings:
- The contractor handled the tailings about three times on the way to final placement to accelerate dewatering process.
- As the tailings became dryer, the angle of repose approached nearly vertical
- A three-day set up time was required for each tailings layer before adding each layer.

Design Flexibility:
Given the uncertainties in topography and in the definition of the extent of the removals, it was beneficial to have a design with sufficient flexibility to allow adjustment as necessary to reflect unanticipated field conditions. The flexible elements for the Moon Creek project were the cap and a conservative foundation design that provided the ability to add additional height to the Combined Waste Containment.

Good Team and Teamwork Key to Successful Project Implementation:
A good team and good teamwork are the keys to successful project implementation. A good collaborative working relationship was established between the USFS, RIDOLFI, and Environmental Reclamation Inc. (ERI) personnel involved in this project. Each member of the team has independently confirmed that this was an essential element to the successful completion of a complex project like Moon Creek.

Case Study Summarized from the Land & Water article authored by Susan M. Alvarez, P.E. Senior Civil Engineer, RIDOLFI, Jeff K. Johnson, Geologist, USDA-Forest Service Region I, Idaho Panhandle National Forest, and Rob Spafford, PE, USES Coordinator, RIDOLFI.