



Case Study

application | **Landslide Repair**
location | **Mississippi River, Otsego, MN**
product | **Miragrid® & Mirafi® 180N**

job owner | **Wright County, MN**
engineer | **Gale-Tec Engineering, Inc.**
contractor | **Veit Company**

TenCate™ develops and produces materials that function to increase performance, reduce costs and deliver measurable results by working with our customers to provide advanced solutions.

THE CHALLENGE

A landslide occurred as a result of high Mississippi River waters pounding into 50 ft. high section of very steep slope during the spring of 2003. Smaller slides had occurred over the past few years in this area. The landslide extended into the northbound lane of C.S.A.H. No. 42 with the potential for the loss of the southbound lane.

The project entailed re-construction of over 750 linear ft. of slope extending up from the normal river level 50 ft. at a 1H:1V slope angle. The road needed to be removed, a detour implemented, and then replaced after slope reconstruction. The finished product needed to be designed and constructed over a 4-month window of opportunity in order to complete the project before winter. Numerous regulatory agencies including the Corps of Engineers, the Department of Natural Resources-Division of Waters and the Division of Fish and Wildlife, the Soil and Water Conservation Service and the Mn/DOT State-Aid Disaster Committee all needed to be contacted for necessary permits or approvals.

THE DESIGN

Gale-Tec Engineering, Inc. first implemented a temporary holding system of helical screw anchors, a Mirafi® 180N geotextile and chain link fence to prevent additional ground loss during the two months it would take to evaluate and design the repair. Repair systems that were analyzed included gabion walls, soil nails, lightweight fill and mechanically stabilized earth systems. The distance between the river and the top of the slope allowed for either a very high retaining wall or the creation

of a very steep man-made slope of 1H:1V. The most cost effective design, and that chosen for the repair, included a combination of high tenacity polyester TenCate products ranging from Miragrid® 5XT to 10XT and with a riprap facing with a graded filter system consisting of Mirafi® 180N and sheet pile for protection in the flood zone and a cellular confinement system facing with a special fertilizer/seed mix in the upper portion of the slope.

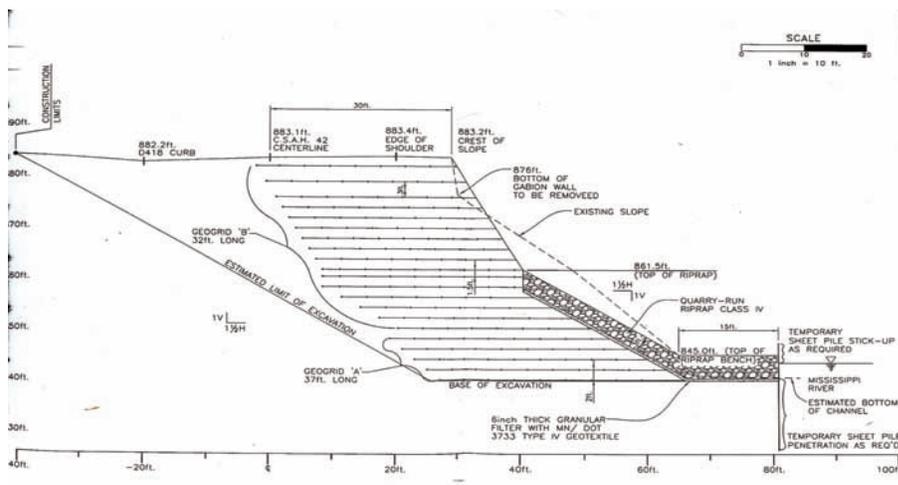
The geogrid chosen (Miragrid®) consists of high tenacity, high molecular weight polyester fibers capable of tensile reinforcement between 2200 and 4300 pounds per foot long-term allowable design strength. Embedment lengths of nearly 40 ft. was determined based on limit equilibrium analysis.

THE CONSTRUCTION

The Contractor initially began his excavation below normal Mississippi River water elevation in order to establish a necessary base for construction. The sheet-pile cofferdam was specified to maintain a water-tree excavation.

Graded granular filter including a Mirafi® 180N with a Mn/DOT Class IV quarry run riprap with pieces between 8 pounds and 200 pounds were used within the 500-year flood elevation for the river. Construction then proceeded up in 1 ft. lifts. The back slope excavation was controlled by Occupational Safety and Health Administration (OSHA) Standard for Excavations 29 CFR Part 1926 and required obtaining an additional 30 ft. construction easement from property on the side of the road opposite the Mississippi River. The Contractor was required to complete the entire project in 60 calendar days in order to allow the replacement of the bituminous roadway prior to the shutdown of the asphalt plants in Minnesota in mid-November because of cold weather.

A special seed mix consisting of a deep-rooted prairie perennial grass was used within a 6-inch high cellular confinement system web with a green face. Topsoil and seed mix along with a special natural organic plant food was hand mixed into the web. The fertilizer included slow release nitrogen that is an excellent grass starter with low burn potential. The natural



Detail of installation section by Gale-Tec engineering.

fertilizer used was compost based that is heated in process in order to stimulate the microorganism growth.

THE PERFORMANCE

The reconstruction of this Landslide has restored the magic and majesty of the Mississippi River which will be the emphasis of the Grand Excursion 2004 Celebration which will commemorate the transformation of the upper Mississippi and its communities during a year long salute. This collaboration of more than 50 river cities and 23 regional organizations will showcase over \$5 billion of capital, economic and environmental improvements to the area around the River according to Patrick Seeb, Chair of Grand Excursion 2004 and president of the St. Paul Riverfront Corporation.



Placement of riprap on a granular filter over Mirafi® 180N during low river waters.



Deployment of Miragrid® geogrids as the embankment is half completed.

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