



## Case Study

application | **Retaining Wall**  
location | **Stillwater Mills, MN**  
product | **Miragrid® 3XT, 5XT, & 8XT**

job owner | **Weis Builders, Inc.**  
engineer | **Civil Solutions Group**  
contractor | **Structures Hardscapes Specialists**

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

How to design for a 12.2 m (40 ft) change in grade along the backside of a proposed upscale condominium project located along the St. Croix River in historic downtown Stillwater, MN. There was minimum room for excavation due to the location of the proposed condominium and the adjacent existing roadway along the back of the property. The site geotechnical investigation indicated the presence of limestone bedrock and a perched water table leaching through the limestone bedrock along the backside of the property.

### THE DESIGN

ReCon was the retaining wall unit of choice by both the City of Stillwater and the Heritage Preservation Commission because a properly stained ReCon unit closely matched the exposed limestone bedrock formations located throughout the historic area. After a review of the proposed Site Plan and the Site Geotechnical Investigation, Civil Solutions Group (CSG) requested additional borings be performed in the area of the retaining wall to get a more definitive location of the bedrock. CSG also requested that the geotechnical engineering firm (Braun Intertec) provide them with an acceptable design strength for the bedrock based on cored rock samples or their experience, as CSG had determined rock anchors and geogrid to be the optimal tie back method of choice due to minimal excavation limits along the back of the wall for the given wall height. Upon receipt of this information, CSG completed the wall design and it was put out to bid to experienced local contrac-

tors only. The initial design included a rock anchor tie back system into the bedrock, a geogrid tie back system above the bedrock, and drainage mat that extended up to the top of bedrock to divert the perched water table. The entire project was found to be over budget and the site and condominium project was redesigned and alternative designs were then solicited.

Civil Solutions Group evaluated the revised Site Plan and found that the wall had been moved outward from the existing road a sufficient distance to accommodate minimum Miragrid® geogrid lengths of 50% (0.5H) of the total wall height. This allowed the wall to be designed as a Miragrid® reinforced retaining wall, using the ReCon Retaining Wall System facing units. This option eliminated the more costly earth anchor alternative.

### THE CONSTRUCTION

The wall construction was completed by Structures Hardscape Specialists out of

Minneapolis, MN. The initial construction required a significant amount of dewatering due to heavy rainfalls and extensive water seepage through the perched water table(s). A temporary detention basin was created to remove the excess water along the wall base and allow for the installation of the base course units.

There was undercutting required near the end of the wall at the base course unit locations due to the presence of unsuitable bearing material. This unsuitable material was subcut to a depth required to reach suitable bearing material and replaced with crushed stone up to the wall base elevation. In areas of extensive subcut requirements, a row of ReCon Units was used in addition to the crushed stone.

An additional zone of unsuitable bearing material was also encountered where the wall transitioned from a 40' wall resting on bedrock to a 10' wall on soil. The depth of the unsuitable material could not be determined by the site geotechnical engineer, so CSG proposed a series of H-Piles with a Pile Cap to support the wall in this area.



The design by CSG required that H-Piles be driven @ 6' O.C. into competent bedrock and capped with an H-Pile beam to support the retaining wall facing units in this area. Crushed stone was filled on top of the H-Pile beam up to the wall base elevation. The walls are currently under construction, and a September completion date is anticipated.

**THE PERFORMANCE**

All parties involved were completely satisfied with the design, construction and final result of the project. The ReCon Retaining Wall is a very impressive and aesthetically pleasing structure and is an ideal solution given the local limestone bedrock formations.



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