

Eagle Gold Mine emergency spillway lining using Geosynthetic cementitious composite mats (GCCM)

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ABSTRACT

GCCMs are a relatively recent development within the world of geosynthetics and are fast becoming a popular alternative to conventional concrete construction for a wide range of erosion control applications such as channel lining, slope protection, culvert lining, remediation, bund lining and weed suppression. Typically, GCCMs are used as an alternative to conventional concrete techniques such as poured, sprayed or precast concrete. A good case study example of this is the Eagle Gold emergency spillway lining in Canada, installed in 2019 which is outlined in this abstract.

ASTM D8058 defines GCCMs as ‘a factory-assembled geosynthetic composite consisting of a cementitious layer contained within a layer or layers of geosynthetic materials that becomes hardened when hydrated’.

GCCMs are flexible prior to hydration and set hard on the addition of water to form a thin, durable, waterproof concrete surface. They consist of a three-dimensional fibre matrix filled with a high early strength cementitious powder mix. Once unrolled and fixed in position they can be hydrated by spraying with water and typically set to 80% full strength within 24 hours from initial hydration and are then ready to use.

The material construction typically consists of 3 layers:

- A hydrophilic fibrous top layer (typically polyester)
- A 3-dimensional fibre reinforcing matrix filled with a specially formulated dry, high early strength cementitious blend
- A low permeability polymeric bottom layer (typically PVC)

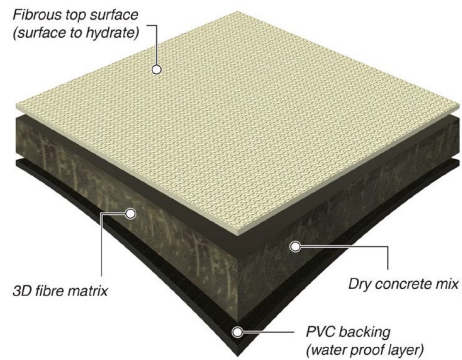


Figure 1. Section of a GCCM.

In May 2019, GCCM was installed as a spillway erosion control liner for two spillways at a large gold mine site in Northern Canada. One spillway connected a heap leach pad to an events pond. The second was an emergency spillway for the events pond. The spillways formed part of the Eagle Gold Mine, operated by Victoria Gold, located in northern Yukon, approximately 200km from the Alaskan Border. The local area is subjected to seasonal variance of 20° C to -30°.

Alternatives to the specified GCCM that were considered included poured concrete with an applied coating, but was discounted due to concerns about the required logistics and installation rates. The project was required to be completed in a relatively short construction window prior to the winter period.

The spillways were designed to convey any overtopped heap leachate in the case of extreme weather events. The spillway would only likely experience any flow in the case of a 200-year storm event. The site is heavily monitored by the Canadian mining regulator and Ministry of Mining.

The main spillway is approximately 500m in length with profile sections of 5-8m at 7-15%. The second emergency spillway is approximately 140m in length of varying width at 50% gradient. 8mm thickness GCCM was used for fall sections of 7.5% and 13mm thickness was used where the fall of the section increased to 15%. The emergency spillway was approximately 140m in length of varying width at 50% gradient and lined exclusively with the 13mm thickness GCCM as per the engineering consultant's (BGC Engineering) specification.

The main spillway was installed as per standard manufacturer detail; hydrated overlaps, beaded sealant between overlaps at 200mm centres, 100-150mm overlap with a 1.3m anchor trench (0.75 x 3) along either crest with ground pins. It was calculated that the main spillway did not require intermediate fixings. The emergency spillway was fixed to the substrate using rock anchors at fixings not less than 1.8m centres along its main section. At the 90° corner, anchor centres were not less than 0.5m apart.

The onsite contractor, JDS Energy and Mining Inc installed the material at a rate of 750 – 850sqm per day at 15° temperature. The use of GCCM for the lining of the spillways allowed the contractor to complete the works in the short available construction window and provide a long term, durable protective lining to the channels able to withstand the extreme environmental conditions.

