American Excelsior Company®

Channel Erosion Done Right
Avoiding the Race to the Bottom

Case Study - Iowa Department of Transportation I-80 Median Project

Introduction

"The race to the bottom," as some would call it, is a disturbing trend right now in the erosion and sediment control industry. This means the cheapest product is being used on projects across the country because they are incorrectly placed into the same categories as higher performing products, which typically cost more. Specifications have become watered down too much in some places; for example, a straw blanket is considered equal to aspen excelsior and coconut erosion control blankets (ECBs) in areas of concentrated flow. Decades of data, field experience, and a basic understanding of the characteristics of each product type have proven that straw blankets are not the best management practice (BMP) of choice for channelized flow conditions. However, there is a positive trend in the erosion and sediment control industry. Currently eight state transportation departments officially do not allow straw blankets in areas of concentrated flows because of performance concerns. Other state transportation departments are considering disallowing the use of straw blankets in areas of channelized flow. Straw blankets work very well as mulch blankets in areas that do not contain concentrated flow. It is simply a case of using the right product for the right application. Every product has its place and generally most BMPs available today perform when properly installed in the proper application, but no one product is the magical silver bullet that can be installed in every application. It is our duty to the environment and future generations to specify and use products properly designed for the conditions where they are used.

The Challenge

The Iowa Department of Transportation (DOT) had a challenging 2.25 mile-long ditch median near the Interstate 80 Avoca interchange. The long run caused concentrated flows in the median that "standard" erosion control products would not withstand. Extensive soil erosion in the median was not only an eye sore to motorists, but the erosion was causing a public safety concern to the roadway. The project also crossed two branches of the Nishnabotna River so successful erosion and sediment control was a must to protect the precious waterways. To further complicate matters, the cross-over that was required for the resurfacing project increased the concentrated flows to the median. The highway median had gullies 18 to 24 inches deep and a couple of feet wide before the final solution was devised. As the project owner, the Iowa DOT turned to its specifications for special ditch control that allow double-netted aspen excelsior wood fiber ECBs or double-netted coconut fiber ECBs. Products used on this project included Curlex® II .98 ECBs and Curlex® Sediment Logs (See Figures 1-3).

Figure 1. Curlex® Great Lakes Aspen Excelsior Fibers

Figure 2. Curlex® Sediment Log®

Figure 3. Curled & Barbed Curlex® Excelsior Fibers

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Project Team

Smith Seeding, of Eldridge, Iowa, completed the erosion and sediment control work on the project. They elected to go with the double-netted aspen excelsior ECB option that met or exceeded the Iowa DOT's specifications for channelized flow applications. Coleman Moore Company out of Des Moines, Iowa, supplied Smith Seeding with Curlex® II (.98 version) aspen excelsior ECB to line the median. The naturally seed-free matrix of the Great Lakes aspen excelsior ECB contains engineered curled and barbed fibers designed specifically for erosion and sediment control that expand when wetted and contract when dried. The unique fibers "dig" into the soil from the expanding and contracting process. The surface roughness of the aspen excelsior ECB also increases when the fibers expand, which helps reduce the flow velocity of runoff. In addition to superior erosion control capabilities, the aspen excelsior ECB matrix provides ideal growing conditions for vegetation. Curlex® is manufactured by American Excelsior Company® at its plant in Rice Lake, Wisconsin. All of American Excelsior Company's products, including Curlex, Recyclex®, and Sediment Log® brand products are available through Coleman Moore Company along with a plethora of other erosion control and geotextile BMPs.

The Plan

Damming structures previously used in the highway median had to be removed first because they caused accelerated erosion in the median. Increased hydrostatic pressure created by ponded water in front of damming products can initiate the erosion process. As the water depth and hydrostatic pressure increase, the downward force can cause scour directly under the dense object. Moving water tends to take the path of least resistance. Thus, as downward force is continually increasing with water depth, the weakest point in the channel becomes the path of least resistance. Commonly, this weakest point in the channel is under damming devices. These basic physics commonly cause scour underneath damming products as seen in Figure 4. A direct conduit for contaminated runoff is created as soon as water scours under dense devices. When scour under a damming product occurs, it makes them almost obsolete in terms of environmental protection benefits because of the direct flow path under them.

Figure 4. Scour under damming device caused severe erosion. These failures led to complete rework of the area with Curlex® II .98 erosion control blankets and Curlex® Sediment Logs.

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The Plan...cont.

The site contained disturbed clayey soils that were far from ideal for establishing vegetation so six inches of topsoil was added to the site. After properly grading the median, a special seed mixture was applied. The sloping median had an average bed grade of 4.3% over the 2.5-mile stretch. The challenging soil conditions and long continuous stretches of concentrated flows prompted Mike Heller, certified professional in erosion and sediment control and agronomist for the Iowa DOT, to specify a standard seed mixture combined with stabilizing species to help ensure quick vegetation establishment. Limiting the time between unvegetated ECB conditions and final vegetation in the median is always a good standard practice to follow when it is possible. The seed mixture was comprised of 100 pounds per acre tall fescue, 75 pounds per acre perennial rye, 20 pounds per acre Kentucky blue grass, 15 pounds per acre grain rye, and 15 pounds per acre oat grass. The plans also included four waterings separated by five to eight calendar days. Watering is a pay item in the state of Iowa and can be a crucial part of overall project revegetation success.

Executing the Plan

A 20ft x 20ft splash pad was installed at the end of the culvert coming off the cross-over. Also, three inch nominal limestone was added at the culvert to help mitigate flow velocities coming off the cross-over before the flow entered the median. Porous filtering devices were needed in the highway median. The devices work with Mother Nature and allow flow through them, which may be a more suitable option for areas of concentrated flows. Filtering devices have a flow rate of at least 35 gallons per minute per square foot and dissipate runoff velocity as their flow rate is exceeded. Filtering devices give you “the best of both worlds” because they provide both velocity reduction and filtering. It is very important to allow flow through aspen excelsior products so contaminated runoff can contact the matrix and filtered water can be released. Dense designs do not allow water to contact the fibers, so filtering does not have a legitimate chance. Materials made of the exact same matrix can perform drastically different at different densities. Laboratory and field research has shown that more porous products work better because dense versions of the same exact matrix tend to cause scour in channelized flow applications. With this in mind, Curlex Sediment Logs were installed over the ECBs across the median, perpendicular to the flow of water to filter contaminated runoff and dissipate the flow velocity (see Figure 5). The logs contain engineered, curled and barbed Great Lakes Aspen excelsior fibers. 80 percent are a minimum of six inches long and 0.031± 0.008 inches wide x 0.027± 0.006 inches thick. These fibers have been proven to be ideal for sediment control filtering matrices. Larger wood fibers, or chips tend to float during hydraulic events. Smaller wood fibers such as mulch-like materials or saw dust tend to compact too much resulting in a dense, damming matrix.

Figure 5. (May Year One): Curlex® II .98 erosion control blankets are double-netted for higher performance. They were installed in conjunction with Curlex® Sediment Logs which are porous and engineered to both dissipate velocity and filter stormwater runoff before the median discharges into the Nishnabotna River. Both products are made from sustainably harvested Great Lakes Aspen excelsior fibers.

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Executing the Plan...cont.

The type of wood fiber is also extremely important. Aspen excelsior fibers are free of toxins and have been successfully used in revegetation efforts since the 1960s. Other wood types, such as pine, contain toxic resins and should not be used for erosion control, sediment control, or revegetation applications. Pines are high in terpenes, which are a class of hydrocarbons similar to many found in gasoline or paint thinner (i.e. turpentine). Further, the matrix of sediment control devices can have negative environmental impacts, if not produced from a known, controlled raw material. If allowed, non-engineered matrices should provide certified testing on each shipment to verify nutrients, heavy metals, noxious weed seeds, invasive species, or other detrimental contaminates will not be released from them during hydraulic events. For example, Gulliver (2011) and the Minnesota Pollution Control Agency published a report stating that compost releases phosphorus into water when it is in contact with it. It is imperative to know what is going into our environment so we need to learn all the facts about available sediment control products before using them and never assume they are "all the same."

Results

In total, more than 26,000 yd^2 of ECBs and 26,800 ft of filter logs were used on the sensitive 2.5-mile project. According to Heller, the vegetation establishment is great and the project has not had any noticeable erosion or visually contaminated flows discharging from it (see Figure 6). Heller summarized the project by stating, "We were able to resolve a public safety concern and make it more aesthetically pleasing by using quality erosion and sediment control products to meet our challenging conditions."

There you have it. Channel erosion can be controlled when using the right products for the right application and avoiding the race to the bottom.

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Figure 6. After (July Year One): The challenging highway median is becoming permanently stabilized by vegetation only approximately two months after installation of Curlex® II .98 erosion control blankets and Curlex® Sediment Logs.

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