GSE MineDrain Geocomposite

INTRODUCTION
Heap leaching is a mineral processing technology whereby large piles of mineralized rock are irrigated with either a weak alkaline solution or a diluted acid to leach the target mineral. Leach pads are often divided into four categories: conventional or “flat” pads, dumps, valley fills (collectively “static” pads) and dynamic on/off pads. Conventional pads are relatively flat and the ore is stacked in relatively thin lifts (5 to 15 m typically). Dumps are similar but the ore is generally uncrushed and of a very low grade. Valley fills are just the leach pads built in natural valleys using either a buttress dam at the bottom of the valley or a leveling fill within the valley. The overburden stress on the liner system is the depth of the ore times the density. Dynamic pads are universally graded to a near flat plane as the off-loading process requires precise knowledge of the evaluation of the liner relative to the depth of excavation. For dynamic pads, the maximum depth of ore is generally not important to the liner system design. The typical liner-overliner system for heap leach pads consists of (from bottom up):

- Prepared subgrade of low to moderate permeability soil,
- 1.5 to 2.0 mm thick HDPE or LLDPE geomembrane,
- Drainage pipe network consisting of 65 to 100 mm diameter dual-wall corrugated perforated drainage pipes (lateral) feeding larger diameter collectors; and
- Drainage layer (overliner) of crushed gravel, nominally -15 to -40 mm maximum particle size placed in a single layer of 300 mm to 600 mm thickness.

A HIGH STRENGTH HIGH FLOW SYSTEM
An innovative drainage geocomposite with performance exceeding that of natural gravel drainage materials.
INNOVATIVE GEOCOMPOSITE OVERLINER DRAINAGE SYSTEM

The crushed stone meeting the specific gradation is expensive and often time-consuming to procure. Sometimes, it takes several weeks for a gravel of the required gradation to be delivered to the jobsite. It is also not desirable to place a crushed stone directly against the geomembrane. An alternative is needed that will help alleviate the cost and time- constraints of the select gravel layer while meeting the drainage and geomembrane protection requirements. GSE has developed an innovative drainage geocomposite specifically for heap leach pad application. This drainage geocomposite consists of GSE’s patented PermaNet geonet with a nonwoven needle-punched geotextile bonded to one or both sides. The high density polyethylene core of this innovative material does not crush or collapse under very high normal loads of the overburden ore in heap leach pads. The geotextile performs the filter function and ensures the uninterrupted flow of pregnant solution. The installation of this material is significantly faster than aggregate drainage layer and the damage to the geomembrane liner is significantly less compared to the gravel layer alone.

PERFORMANCE OF MINEDRAIN

GSE has evaluated the performance of MineDrain under a rigorous and comprehensive test program. This test program simulates the response of the material under possible site application in actual heap leach pads. The test program included large-scale puncture, compression creep, transmissivity and shear strength tests. For a full report on this test program, please see the MineDrain Technical Note.

COST COMPARISON

The average cost of an installed liner system (grading, subgrade preparation, and geomembrane) in 2010 was around $29 per square meter with a range of $16 to $59 per square meter. The estimated cost of the overliner gravel is $11 to $22 per square meter. The overliner drainage stone is about one-third of the total cost of the liner-overliner system and overliner costs have been escalating faster than general construction costs. This is because projects are increasingly remote, are increasingly large, and have less abundant borrow source options. The overliner gravel is also a common source of both cost overruns and project delays (due to unplanned borrow or screening problems). One goal of many construction managers is to reduce the reliance on select or engineered gravels to avoid these risks. The use of MineDrain can be a key in realizing such a goal. MineDrain can replace the select gravel layer partially or completely at a lower cost. Often MineDrain can be used with a lower quality overliner with tremendous cost savings. The cushioning effect of the MineDrain protects the liner from damage and minimizes or even eliminates punctures of the geomembrane. The result is additional revenue and protection of the environment.

PERFORMANCE TRANSMISSIVITY

The MineDrain drainage geocomposite can withstand extremely high compressive loads. This makes MineDrain especially suitable for use as a drainage and separation/protection layer under extremely high loads of large heap leach pads. The MineDrain drainage geocomposite provides sufficient in-plane flow capacity to transport leaching solutions effectively even under extremely high overburden stress. The transmissivity of MineDrain exceeds that of a 50 cm thick gravel drainage layer. MineDrain separates the geomembrane from overlying rock or ore and significantly reduces the potential damages to the liner during both construction stage and long-term service life.

<table>
<thead>
<tr>
<th>Materials</th>
<th>Load = 100 Meter Ores</th>
<th>Temperature = 60°C</th>
<th>Duration = 10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSE MineDrain</td>
<td>2.16 x10^-4 m^2/sec</td>
<td>Not suitable due to</td>
<td>roll-over failure</td>
</tr>
<tr>
<td>Other conventional geonets</td>
<td>Not suitable due to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-cm sandy gravel</td>
<td>2.5 x 10^-4 m^2/sec</td>
<td>(typical)</td>
<td></td>
</tr>
</tbody>
</table>

[Transmissivity Comparison Chart]

ENGINEERING SUPPORT

The GSE Engineering Support Staff is comprised of multidisciplinary product professionals to support you across a range of project requirements. This includes knowledge in geomembrane, geosynthetic clay liners, geonet, geocomposite, nonwoven geotextile and concrete protection products and application solutions. Rely on our technical staff to help you solve your project issues.